The

DENTAL JOURNAL

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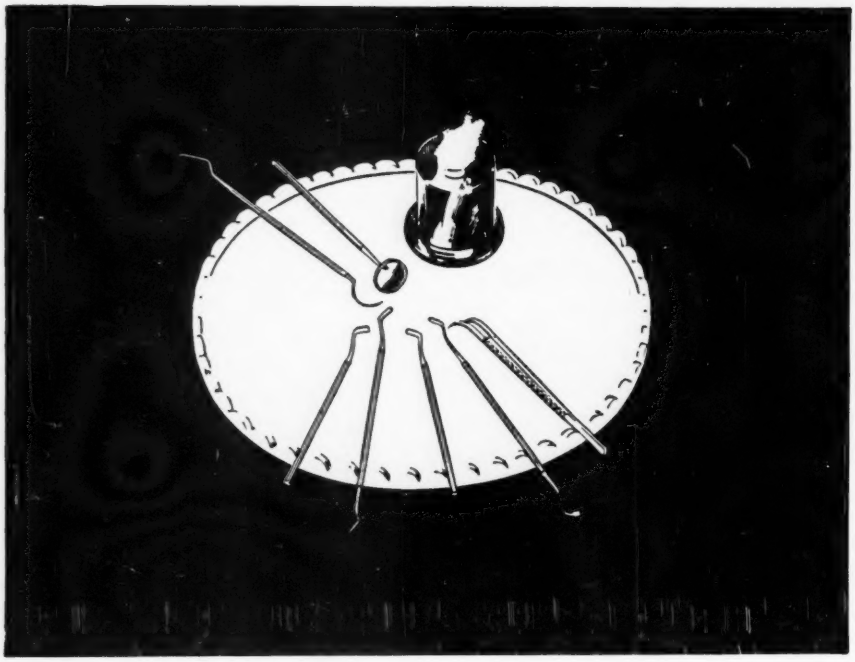

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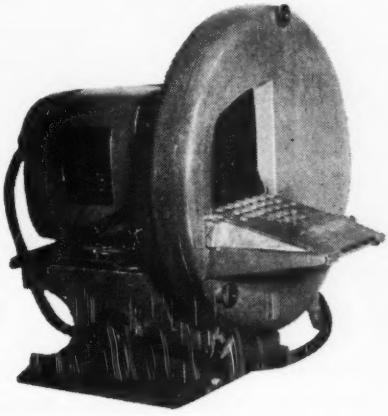

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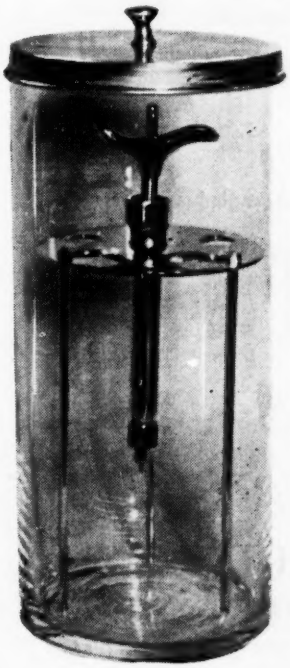

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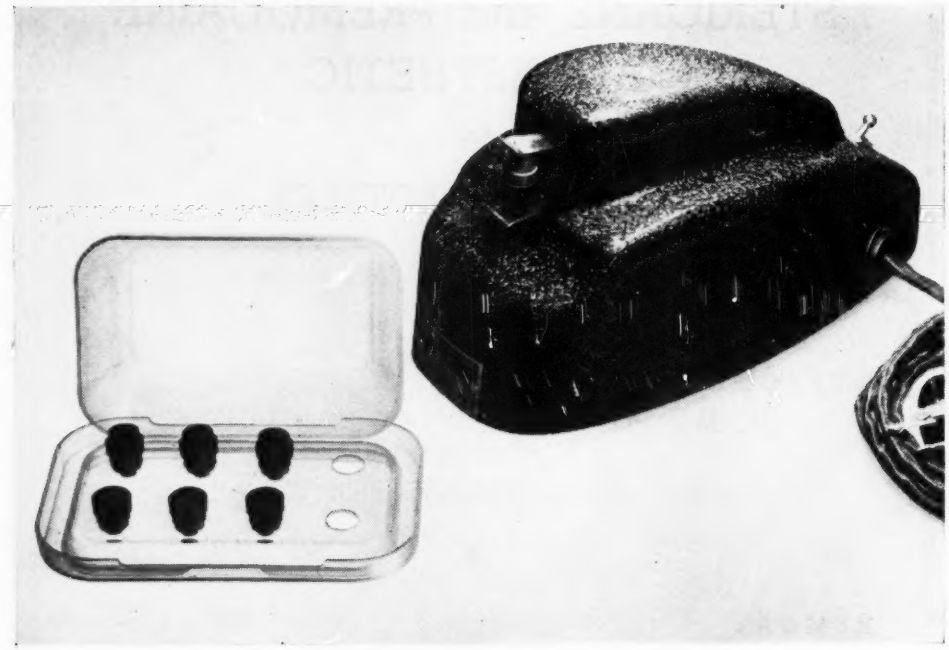

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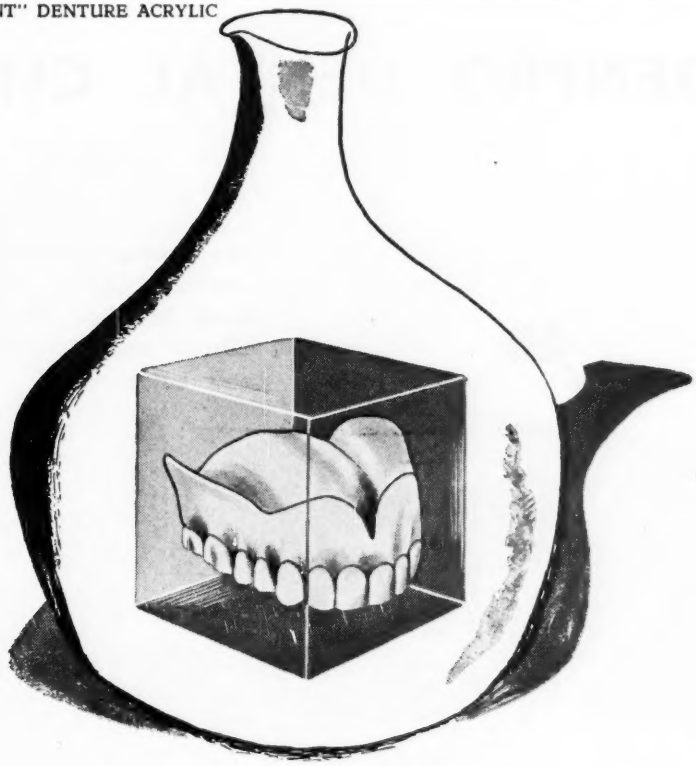

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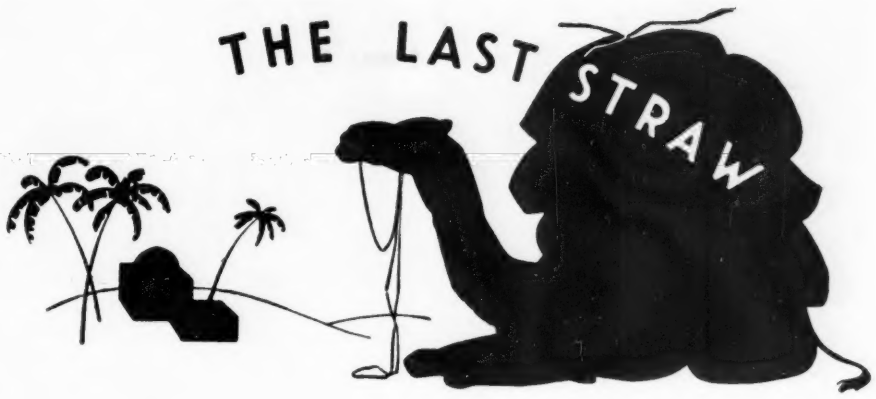

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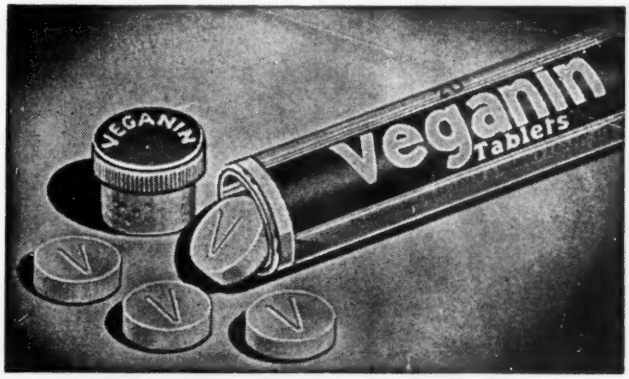

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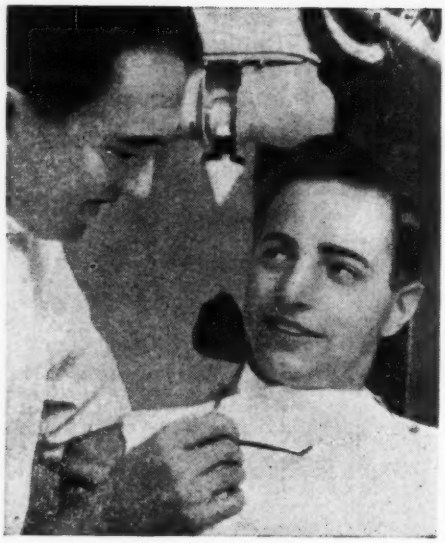

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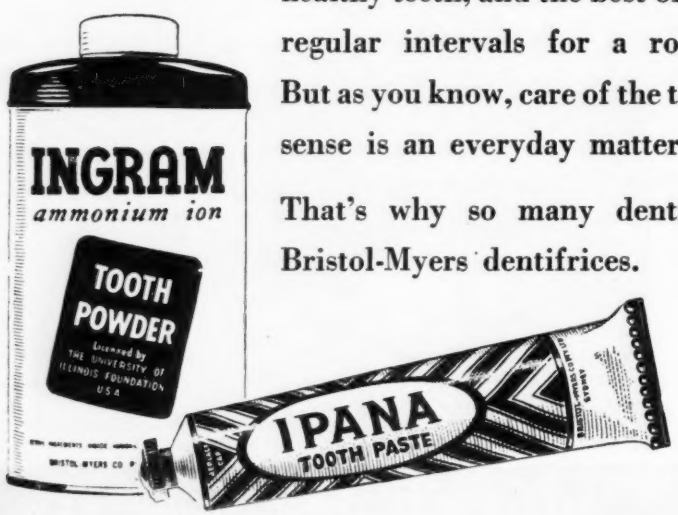

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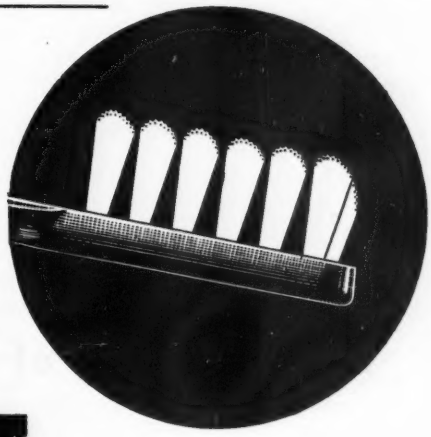

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A Fundamental Approach to Recording Centric Relation in Full Denture Construction*

A. Gordon Rowell, M.D.S. (Syd.), D.D.S. (N.U.)†

The last decade has seen many accepted theories and techniques subjected to searching scrutiny by numerous writers and investigators. Despite a fuller knowledge of anatomy and physiology, and a better understanding of the application of physical principles to the behaviour of biological tissue, a perplexing array of often diametrically opposed theories and interpretations has resulted.

The object of this paper is to attempt to survey critically some of the more recent available data, and to present a basic procedure incorporating the best points of a number of techniques in what may be considered to be a rational approach to the registration of centric relation of the maxilla and mandible. Whereas this procedure may be varied considerably to meet special circumstances, and modified to conform to the individual aptitude of various practitioners, the basic principles still stand.

Any rational approach to the procedure of registering centric relation must include an examination of the modern concept of anatomy and kinesiology of the complete masticatory mechanism, and take into consideration those factors which assist, hinder, or even make temporarily impossible the attainment of the object. Finally, it is important to recognise the possible sequellae of failure to apply these basic principles correctly to any technique for centric registration.

There are three distinct static positional relationships of the mandible, the "rest position," the occlusal position, and the centric position. In the *rest position*, the mandible is involuntarily suspended by the reciprocal co-ordinated action of the muscles of mastication and the depressor muscles, with the upper and lower teeth slightly separated.[1] Thompson[2] has shown the rest position to be established soon after birth, and is of the opinion that, except for extraneous factors, it remains relatively unchanged throughout life. The presence or absence of teeth affect this position little if at all. In any case, for any one person at any one time, the rest position is sufficiently constant to allow its use as a basic starting point in the estimation of an acceptable vertical dimension for centric relation. This fact is now so well established that practically all modern techniques for recording centric relation include the use of the rest position while older techniques which included its use did so without possibly recognising the physiological significance of this position.

The *occlusal position* is dependent on the presence of teeth or their artificial substitute. It is the position which the mandible assumes when the teeth come into contact in the retruded position, and may or may not coincide with centric position. If there is a malocclusion of the teeth or artificial substitutes, then the occlusal position will be an eccentric one.

The *centric position* may be described as the maxillo-mandibular relationship when the mandible is moved from the rest position to a position of normal occluding relationship by an isotonic contraction of the muscles of mastication, while at the same time the condyles assume a balanced and unstrained position in the distal portion of the glenoid fossae. A number of authors have described the centric position as the one from which all functional movements of the mandible commence and finish. This is incorrect, however, as it is now known that such movements commence and finish at the rest position.

Anatomical Considerations.

The teeth or artificial substitutes are related to the osseous structures of the lower part of the skull. They cannot, however, be brought into functional occlusion without the aid of muscles, ligaments, and other vital tissues, which require satisfactory nutritional and nerve supply in order to function efficiently. The absence or degeneration of some of the structures may not necessarily completely impair function of the masticatory mechanism, because it is observed that nature tends to compensate for the loss or damage of other than essential organs, and the masticatory mechanism is not exempt from this natural law. For complete efficiency, however, it is necessary that all the components be healthy and capable of normal physiological function.

*Annie Praed Memorial Lecture, 1952.

†Department of Prosthetic Dentistry, Faculty of Dentistry, University of Sydney.

The Temporo-mandibular Joint.

The temporo-mandibular articulation will be discussed as a separate unit for ease of description. However the articulation should not be considered as unilateral in function, as such a concept would permit the possibility of movements within the joint which are impossible because neither condyle can move in any direction without some corresponding movement of the other condyle.

The condylar head of the mandible lies in the glenoid fossa of the cranium, being separated from it by the articular disc which divides the joint into an upper and lower part, each of which is lined with an avascular fibrous tissue which, according to Sicher,[3] may contain a variable number of cartilage cells and then be designated as fibro-cartilage. The upper portion of the joint permits a gliding movement and the lower portion a rotating motion, thus enabling the joint to be aptly described as a "hinge joint with a movable socket."

The anterior portion of the glenoid fossa is separated from the posterior portion by the tympano-squamosal fissure laterally extending into the anterior petro-squamosal fissure and the petro-tympanic fissure medially. Anteriorly the fossa extends to the articular eminence and posteriorly to the posterior articular lip. In a distal displacement of the condyle, the head of the condyle will be directed towards this articular lip and not against the tympanic bone which normally shows no evidence of perforation,[3] even though this condition has been described by a number of authors when discussing temporo-mandibular disorders resulting from overclosure of the vertical dimension. When such perforations do exist, their presence may be explained by causes other than condylar pressure.

The articular disc, formerly described as fibro-cartilagenous[4] but now regarded as a dense fibrous plate of tissue, continues posteriorly into a thick layer of vascularized connective tissue which connects the disc with the posterior wall of the articular capsule.

The joint obtains its lubrication from the synovial capsule which surrounds it, fusing with the entire circumference of the disc. The synovial capsule is strengthened by its fibrous capsule which laterally is specialized and thickened to form the temporo-mandibular ligament. Other ligaments described in connection with the joint although not immediately associated with its function are the spheno-mandibular and the stylo-mandibular ligaments. These ligaments limit excessive movements of the mandible during function and prevent damage to the nerve and nutritional supply of the mandible.

Muscles of Mastication.

The muscles of mastication are the temporal, masseter, external pterygoid and internal pterygoid muscles.

The temporal muscle. Because of the wide source of origin of the temporary muscle, its function may either be elevatory or retractory, depending on whether or not the mandible is in a protruded position at the time the muscle commences to function. The retractory elements of the muscle are those fibres which run almost horizontally from the distal and lower portion of the fan-shaped origin of the muscle to their insertion on the coronoid process of the mandible.

The masseter muscle. The masseter muscle has a superficial part which takes its origin from the zygomatic bone and a deeper part arising from the entire length of the zygomatic arch anterior to the articular eminence. Although the deep part of the muscle fuses with the superficial fibres, the direction of the fibres is almost vertical in the rest position and mesial in the protruded position. The superficial fibres run downwards and backwards to find their attachment on the lateral surface of the ramus of the mandible. The muscle therefore may function as an elevator muscle or a retractor muscle depending on the position of the mandible when the muscle commences to contract.

The internal pterygoid muscle. The internal pterygoid muscle is a medial counterpart of the masseter muscle. It runs downwards and backwards from its origin in the pterygoid fossa and from the maxillary tuberosity and pyramidal process of the palatine bone to its insertion on the medial surface of the lower part of the ramus of the mandible. Due to the direction of the muscle it acts as an elevator muscle with a protrusive component.

The external pterygoid muscle. The function of this muscle has been the subject of considerable controversy. The muscle arises from two sources. The upper portion (sometimes referred to as the sphenomeniscus muscle) arises from the infra-temporal surface of the greater wing of the sphenoid and runs almost horizontally in a disto-lateral direction. The lower and larger portion arises from the anterior surface of the lateral pterygoid plate and running upwards and backwards fuses with the upper head to find its attachment to the articular disc and capsule, and to the anterior surface of the condyle. The function of the external pterygoid muscles is to act together to protrude the condyles, or singly to rotate the respective condyle to which it is attached in an anteromedial direction, modified in vertical relationship by the contour and direction of the

articular eminence. At the same time, a compensatory movement of the articular disc is effected so that it retains its normal relationship to the condyle.

During masticatory function, the external pterygoid muscle is alone responsible for keeping the protruded head of the condyle in its forward position while pressure is exerted on a bolus of food between the teeth on the opposite side of the mouth. It then gradually allows the return of the condyle to its rest position in the glenoid fossa at the completion of the masticatory cycle. The need for the attachment of the muscle to the disc is therefore apparent. The possibility of a subluxation of the joint if the external pterygoid muscle does not completely relax at the instant that maximum force is applied by the elevator muscles can be understood. That subluxation is a frequent occurrence has been shown by the work of Bauerle and Archer,[5] who indicate from their examination of 1200 patients of all ages and dental conditions that 40% of the total number had at least a unilateral subluxation of the temporo-mandibular joint while of 145 of the patients who were edentulous, those wearing full upper and lower dentures had subluxations in 23% of cases, while those not wearing dentures were affected in 40% of cases.

It must be remembered that, in the final opening movement of the mandible, the external pterygoid muscles are assisted by the sub-mandibular muscles and by gravity. It is also important to note that there is no muscle attached to the articular disc or the condyle which will pull either of them directly back into the fossa subsequent to the forward gliding movement. However, normally the articular disc is sufficiently bound to the head of the condyle to ensure that it will move forwards and backwards with the head of the condyle without muscular assistance. This fact has been demonstrated on cadavres[3] where co-ordinated movement of the disc in relation to the condyle is observed without the possibility of any assistance from muscle function, when the mandible is manipulated manually. Where damage has occurred to the joint in such a way as partly to destroy the close adaption of the disc to the head of the condyle, such disorder may be indicated clinically by a clicking in the joint during mandibular movement.

The submandibular muscles are an extremely important group of muscles. They are the digastric, mylohyoid, geniohyoid, thyreohyoid, sternohyoid, sternothyreoid and platysma muscles. In the opening movements of the mandible, these muscles play an essential and complicated role. It is due to their co-ordinated balancing and equalising effect on the direct muscles of mastication that any static position or controlled functional movement of the mandible is possible.

Physiology of Muscles of Mastication and Application of Physiological Principles to Technique.

The ability to observe and record the rest position, and then establish a satisfactory centric relationship of the jaws, will determine to a large degree whether or not pathological changes will occur in the masticatory mechanism subsequent to our administrations.

The complete removal of the natural teeth starts the patient on a course of degeneration of the alveolar ridges and the muscles of mastication. Full dentures cannot be constructed which will allow the masticatory muscles even a reasonable degree of the amount of exercise to which they were accustomed in the presence of a well occluded full complement of natural teeth in healthy periodontal tissues. Generally, the predisposing factors which determined the eventual removal of the natural teeth have already initiated a deterioration through lack of function. Brudevold[6] demonstrated that the maximum force appliable with dentures varied from 4 kg. on the first bicuspid to 9 kg. on the first molar, in comparison with 75 kg. on the natural sound dentition.

Is it any wonder that the prosthodontist is plagued with patients demanding a reconstruction of their physiognomy which had previously been assisted by healthy muscles together with a nutritional advantage brought about by the patient's ability to masticate normally?

By a study of kinesiology, that is the science concerned with muscle movement in man, its principles will more readily permit at least the prevention of unavoidable further deterioration rather than hasten the progress of pathological changes.

The muscles of mastication are essentially skeletal in structure. As such, they are elastically extensible. When they are stretched, tension within the muscles increases proportionately as the fibres are lengthened. If effective working length of the muscle is shortened, tension is decreased within the muscle, and its ability to function maximally is decreased. From the point of view of exerting tension, muscles function more efficiently at rest length in most cases, with the tension of the contracting muscle increasing with length over the limits of physiological utility.[7]

In the state of rest, muscles are slightly contracted. To retain them thus, there is a

continuous interchange of responsibility between muscle bundles within the muscle, because a muscle fibre either contracts maximally or not at all. The force applied by a muscle is therefore directly proportional to the number of muscle fibres which contract at any one time. Were this interchange of responsibility not possible, the muscles would soon fatigue and the maintenance of a rest position, or any other position, would be impossible. No mandibular movements are possible without the shortening of selected muscle groups, automatically associated with lengthening of antagonist muscles.

Rest position and the point of maximum power coincide and are the same point only in about 65% of cases,[7] therefore any attempt to use a method of recording maximum biting force as synonymous with the rest position cannot be regarded as uniformly accurate. The Boos Bimeter appliance[8] would therefore come under this criticism, although it is acknowledged that various estimations of the free-way space are made depending on the amount of pressure recorded in each case.

It is now possible to understand the effect of eliminating the free-way space in recording a vertical dimension. In attempts to "open the bite" for reconstructing a lost vertical dimension, unless a free-way space is observed, excessive tension is built up within the elevator muscles attached to the mandible. These are a strong group of muscles and their natural tendency to return to their normal rest lengths will cause loss of alveolar bone under the denture bases until such time as a free-way space is again achieved. This fact has been proved experimentally in animals[9] and observed clinically in humans.

When the correct vertical dimension is considerably under-estimated, or when it has been lost through gross bony destruction of the alveolar ridges, among other sequellae, the elevator muscles function inefficiently due to their loss of effective working length. The external pterygoid muscles, however, are stretched due to the backward movement of the condyles in the fossae thus causing an increased tension in these muscles. Either a subluxation of the joint or a slow and gradual bending forward of the head of the condyle may result.

While it is important to recognise the principles outlined by Thompson[2] in regard to the establishment and maintenance of the rest position throughout life, the effect of habit, posture, conditioned reflexes and neuromuscular stimuli must not be overlooked.[10]

Obviously, tonus of the elevator muscles is determined to a large degree by the general health and the mental state of the patient, and these conditions together with posture must be taken into consideration when estimating an acceptable vertical dimension.

Pain in the temporo-mandibular joints or even uncomfortable or hurtful denture bases or base-plates can rapidly induce conditional reflexes which only the eradication of the cause of the pain or discomfort will eliminate.

The presence of a full complement of posterior teeth or the presence of well balanced dentures causes the major and initial stress of mastication to be borne in the bicuspid first molar region. Overclosure of the denture space, the absence of soundly occluding posterior teeth, or satisfactory substitute, causes the mandible to function in the occluding position as a Class III lever, making a fulcrum of the condylar head on the articular disc, and causing the condyle to function generally in a more distal position in the glenoid fossa. Whereas the temporal, masseter and internal pterygoid muscles then function in a shortened manner, the external pterygoid muscles are functionally lengthened.

In some advanced cases of over-closure (more than 10 mm.) it has been demonstrated that the meniscus was pulled so far forward that, except in excessive protrusive movements of the mandible, the bony surfaces of the joint were separated by hyaline cartilage only and in some cases even that was penetrated by wear.[11]

Although there is considerable divergence of opinion as to the anatomical possibility of direct impingement on structures such as the chorda-tympani, anterior tympanic artery and the auriculo-temporal nerve,[3] all of which bear an intimate relationship to the temporo-mandibular articulation, there is no doubt in the author's mind that if not by direct stimulation, then at least by indirect stimulation of these structures, certain neurological symptoms may develop, such being now well known under the name of Costen's Syndrome, when the condyle is forced to function too distally in the fossa. The proof of this lies in the fact that clinical evidence demonstrates that in cases where it can definitely be established radiologically that there is a temporo-mandibular disorder with the condyle functioning further distally in the fossa than normal, and with Costen's Syndrome symptoms present, occlusal reconstruction brings considerable relief in many cases, and in fact in a number of cases an almost dramatic complete cessation of symptoms in an amazingly short period of time. The symptoms of such temporo-mandibular disorders, described by Costen,[12] may include any of the following: pain in or around the temporo-mandibular joint, neuralgia, traumatic, noisy, limited in excessive movement of

the mandible, burning, prickling sensation of the tongue with perhaps accompanying herpes, a metallic taste, dryness of the mouth due to the disturbed function of the salivary glands, and possibly mild catarrhal deafness. In regard to the last mentioned of these symptoms, although a number of cases have been reported where improvement in the hearing has been claimed following correction of the malocclusion, the mechanism by which this is achieved and the initial cause of the symptom is not completely understood although there are several plausible theories advanced in this regard.

It must be remembered that even in excessive closure of the vertical dimension, the individual symptoms of Costen's Syndrome need not necessarily be demonstrated as an immediate sequellae. A number of cases of this nature have already been recorded.[13]

In cases where the occlusion is an acquired Class III type caused by the continued use of poorly occluding dentures having an overclosed vertical dimension, the condyle may sometimes function more anteriorly than normal, thus throwing greater strain on the external pterygoid muscles during function. A continuance of this condition may cause a subluxation of the temporo-mandibular joint or a compensatory change in the temporo-mandibular articulation as pointed out earlier.

Walsh[10] has recently stated the importance of recognition of the effect of conditioned reflexes on the balance of the muscles of mastication and has related the effect of body posture to this balance. Not only the rest position, but also the co-ordinated muscle movement needed to register centric relation must be similarly effected. Before the removal of teeth, bad occlusal habits may develop due to malocclusion, or the need for avoiding the painful sequellae of using broken down teeth or teeth supported by imperfect periodontal tissues. The absence of teeth which have not been replaced by a satisfactory prosthetic substitute may also cause a patient to prefer to chew on one side of the mouth and avoid the other. The effects of such imbalance can be observed clinically in a number of cases as either an asymmetrical muscular development in younger patients or an asymmetrical muscular atrophy in older patients.

In one instance, the author has observed a female patient aged 52 who, having had the lower teeth removed some sixteen years before without their being replaced by any denture at all, was unable to move the mandible in any way other than as a simple hinge. It took some three months of exercise and manipulation including the construction of satisfactory dentures before even limited protrusive or lateral movements of the mandible were possible.

Atrophic changes in any muscle from whatever cause may also result in modification of the structure of the mandible and/or the temporo-mandibular articulation. Experimental work performed by Horowitz and Shapiro[14] indicates that loss of the stimulus of function by certain of the masticatory muscles may cause modification of the outer form and the internal structure of the mandible and the temporo-mandibular joint.

In the edentulous patient, habits may have developed due to a malocclusion in the natural teeth before their removal. These habits are not necessarily immediately corrected after the removal of the teeth together with their eccentric guiding influence, and it may take some time before a correct pattern of mandibular movement supervenes. Similarly, with ill-fitting dentures, an occlusal position may develop as a result of a conscious attempt on the part of the patient to either avoid a painful type of occlusal position or in an endeavour to obtain maximum efficiency from unsatisfactory dentures. Although the first movements may be conscious movements, they eventually follow as the result of conditioned reflexes and as such are generally subconscious movements.

Frequently the extra-oral manifestations of an excessively closed vertical dimension are the only conditions which cause the patient to request dental attention. The overclosure may give the patient an appearance of pseudo-prognathism. The tissues become lax, and deep creases develop radiating from the commissures of the lips. Due to the loss of tone in the modiolus, and the folding of tissues at the commissures of the lips, saliva may be permitted to escape in an uncontrolled manner causing, among other things, angular cheilitis. Action to remedy these defects must be considered when determining to what extent the vertical dimension should be restored as generally this condition cannot be eliminated unless complete restoration of the lost vertical dimension is attempted.

Abnormalities and their Effect in the Registration of Centric Relation.

Too frequently in dealing with a subject of this nature, the case of the patient with an abnormality is disregarded. While it is not intended to dwell on these cases, it is considered that the discusson would be incomplete without some reference being made to them.

Consideration has already been given to the eccentric masticatory pattern formed by habit. Habit, such as mouth-breathing, may similarly affect the rest position, because

the habitual separation of the jaws does not permit an easy estimation of the rest position apart from all the pathological damage of the tissue involved by continued muscle imbalance.

A considerable number of patients are subject to muscular hypertension of the masticatory muscles due to psychomatic disturbances.[15] These hypertensions are not necessarily bilateral nor are they restricted essentially to one set of muscles, but frequently affect different groups of muscles at different phases of the disturbance. Without the use of sedatives and possibly psychiatric treatment, it may be impossible to have these patients relax sufficiently to obtain a physiologically unstrained centric relation.[16] If centric relation is registered in the strained relationship, any improvement in the patient's general medical or mental condition may cause a malocclusion in the dentures which were apparently mechanically perfect at the time of insertion.

Bruxism, or teeth clenching and grinding, also considered to be the result of psychic tension, if persistent after the construction of the dentures may cause more failures than is generally recognised.

Congenital conditions such as malformations or deformities of any of the structures of the masticatory mechanism make the registration of a centric registration difficult if not impossible. Degeneration of or hyperstimulation of the central nervous system from whatever cause may make the assessment of a satisfactory vertical dimension either most difficult or impossible.

Finally, the effect of tumours in and around the jaws and the temporo-mandibular articulation should be considered. In this group such conditions as goitre, macroglossia, macrocheilia, acromegaly, tumours of the floor of the mouth and the salivary glands, large cysts of the mandible and, in fact, any deforming pathological condition either in the osseous or soft tissues in the area may make the registration of centric relation impossible until the pathological condition is eliminated. Even then, the formation of scar tissue postoperatively may introduce similar difficulties.

Considerations Regarding Estimation of Vertical Dimension.

Before attempting to register centric relation it is important to have in mind exactly what one wishes to record. In general, it is agreed that the rest position is sufficiently constant at any one time to be used as the starting point for estimating the acceptable vertical dimension. We know that in the rest position, the opposing teeth are approximately 3 mm. apart anteriorly, when natural teeth are present. This is only an average measurement as the displacement may be from 1 mm. to 5 or 6 mm., without being considered to be abnormal. The fact remains that a free-way space *must* be observed. It is now a matter of deciding how much free-way space to employ. It is suggested that in normal cases if a free-way space of 2 mm. be allowed at the time of centric registration the "settling" of the new dentures and subsequent occlusal correction will increase the space by 1-2 mm., resulting in an eventual free-way space of from 3-4 mm. Aesthetic and phonetic considerations will aid the operator in the final choice in estimating the vertical dimension.

Another problem facing the operator is that of deciding whether or not to restore the full amount of loss in vertical dimension. In general it is considered that with a healthy patient, particularly younger patients, every attempt should be made to re-establish the normal vertical dimension. In elderly patients who have functioned at a considerably closed vertical dimension for a number of years, unless such symptoms as Costen's Syndrome or angular cheilitis are present it is often wiser not to attempt to recover the total loss in vertical dimension, or at least not in one stage. It is found in these cases who usually have little if any lower ridge, and possibly a flabby upper ridge, that the increase in denture space makes the lower denture so comparatively high that the patient is not readily able to make the full muscle re-adjustment necessary without considerable discomfort. Patients in their declining years do not necessarily welcome the attempt to restore loss of vertical dimension completely, and may discard the new dentures in favour of the previous unsatisfactory dentures and nothing is gained.

With any patient, irrespective of age, where painful symptoms of overclosure are apparent and troublesome, the vertical dimension must be completely restored, and the patient advised of the need for co-operation in the difficult period of muscle re-education. The decision as to whether or not recovery of the lost vertical dimension should be effected in one or more operations must lie with the operator after weighing all the circumstances of each case.

Bite-force registration as a constantly accurate method of determining correct vertical dimension has been discussed earlier. In this paper, use of this method is not recommended as following discussion will indicate that a virtually static and non-compression record is considered preferable to any procedure where possible displacing pressure is employed.

It is not proper to close this phase of the discussion without paying some attention to pre-extraction records as an aid to establishing the correct vertical dimension. There is no doubt that invaluable information is obtained from pre-extraction records as to colour, arrangements, size and positioning of teeth and the contour of the surrounding tissues. However, no good purpose appears to be served by recording an actual pre-extraction record of the vertical dimension because firstly there is no entirely accurate method of transferring this record to the patient subsequent to the removal of the teeth. The nearest approach to perfection in this regard is possibly the cephalometric method of measurement,[17] but for normal general practice, this method is out of the question, and in any case is subject to considerable variation as to its absolute accuracy in practical application to date.

It is not intended to suggest that occlusal records are of no value as pre-extraction records preparatory to constructing immediate dentures. What it is intended to convey is that centric records, rather than occlusal records, in these cases would be of greater value. In the cases under discussion, that is, where patients present to have full dentures constructed, having previously worn other full dentures, or perhaps none at all, that pre-extraction data is of little use in establishing the correct acceptable vertical dimension. The operator must also face up to the fact that it is not always wise to carry over the faults of occlusion with natural teeth into the full dentures where many additional mechanical factors intervene. Mention has already been made of the effect on occlusal relationships of conditioned reflexes, and to continue or attempt to continue with these faults in the artificial substitutes by the use of pre-extraction records is nothing but detrimental to a satisfactory result.

It is realised that there are other methods of recording pre-extraction vertical dimension data, such as templates, facial measurements, etc., but when it is considered that the rest position is so constant that it varies little if at all whether or not teeth are present, its use obviates the need for elaborate methods of attempting to record accurately the pre-extraction vertical dimension.

In the final analysis, the "acceptable vertical dimension" is purely an *estimation* on the part of the operator as to what he considers the correct dimension should be for a particular patient at a particular time after taking into consideration the dental and medical history of the patient. Aesthetic and phonetic considerations are a considerable aid in estimating the acceptable vertical dimension, but it must be reiterated that there are no data which will determine for the operator exactly that a particular vertical dimension is the one and only one for any particular patient.

Having determined an acceptable vertical dimension for the patient, it is then necessary to record a centric relationship and that will be the position where, at the acceptable vertical dimension, the condyles are in the most physiologically retruded position in the glenoid fossae. Note that this is not necessarily the most distal position obtainable in the fossae, as the latter position may give rise to unwanted sequellae.

RECORDING CENTRIC RELATION.

Satisfactory casts must first be prepared from impressions which meet all the standard

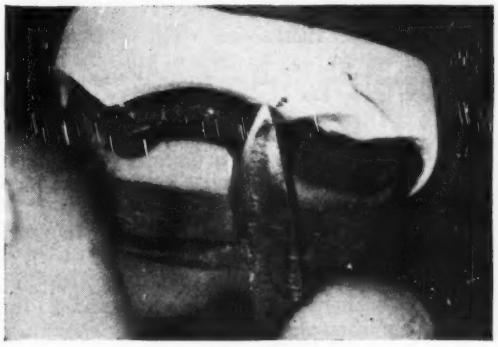

Fig. 1.—Bite-plate firmly seated on cast while bite-rim is adjusted. Such stabilisation prevents possible distortion usually caused by free-hand manipulation.

requirements. On these casts, it is necessary to construct satisfactory bite plates which must conform to the cardinal rules of fitting the mouth accurately and permitting all necessary manipulations without distortion. That means that it is useless to record an accurate centric relation unless such record can be correctly re-oriented on the casts. This will indicate the need to prevent distortion of the bases, and the best method of doing this is

Fig. 2.—Cast covered by layer of 0.001 in. tin foil. Shellac base plate previously adapted to cast is loaded with zinc-oxide impression paste preparatory to seating on foiled cast.

to make no extra-oral adjustments to any bite plate without it being correctly seated on the appropriate cast. (Figs. 1 and 5.) In cases where there are marked undercuts on the model which would cause abrasion of the cast each time the base plate is removed and

Fig. 3.—Appearance of tissue surface of bite-plate after impression paste has set and bite-plate removed from cast.

replaced on the cast, such undercuts should be eliminated temporarily with wax prior to the construction of the base-plate.

Base-plates may be made of acrylic resin, shellac base-plate (preferably lined with a zinc oxide paste and strengthened with firm wire strengtheners—see figures 2 and 3), or any other material which is hard enough to resist distortion within the oral cavity and at the same time not damage the oral tissues. Irrespective of what material is selected for the base of the bite-plate, the base-plate must fit the tissues accurately without causing pain or soreness when firm pressure is applied. If

Fig. 4.—Patient seated comfortably erect in chair with eyes looking straight ahead and head unsupported.

a base-plate hurts the patient, then immediately a reflex tends to prevent the patient closing the jaws in the position where it is hurtful to the patient. Until the base is adjusted so as to be comfortable, it is impossible to record a correct unstrained centric relationship.

The patient should be comfortably seated in the dental chair in an erect posture with the head erect and the eyes looking straight forward. (Fig. 4.) The upper bite rim is placed in the mouth and tested for retention. When retention of the base-plate is satisfactory, the labial frenum region is checked to ascertain whether or not there is correct freedom of movement. If this is not done at this stage, subsequent adjustment may alter the amount of teeth exposed when the lip is at rest in such a way as to interfere with the aesthetics of the finished case. Adjust the labial contour of the bite-rim to the correct aesthetic dimension and then select the length of the upper rim. Although in a number of cases, approximately 1-2 mm. of bite-rim should be exposed when the upper lip is at rest with the mouth slightly opened, this is not an infallible guide. This estimation can

Fig. 5.—Bite-plate seated on cast. Heated composition rim pressed to oiled flat surface (plate-glass) to adjust direction of incisal plane and plane of orientation. After chilling, excess is removed as in figure 1.

only be made satisfactorily with considerable experience. Pre-extraction records, photos, lip curve and actual length of estimated denture space for the upper denture will aid the operator. Test the selected length of the rim by using the sounds "f" as in "fifty-five" when the lower lip should make an explosive sound as it passes over the incisal edge of the upper bite-rim, and the sound "th" as in "this." In the latter case, the tongue should be able to pass comfortably beneath the incisal edge of the upper rim.

Having determined the length of the upper rim, the incisal plane and tooth plane should then be adjusted to parallel the horizontal plane. If the patient is sitting with head erect and so that the alar-tragus plane is parallel to the floor, the horizontal plane for that patient will be parallel to the floor. The easiest method of parallelling the occlusal surface of the bite-rim is to set the bite-plate accurately on the cast. Heat the occlusal sur-

face of the rim and press onto an oiled glass slab until the correction is made. (Fig. 5.) Chill the rim, and remove excess material with a scalpel (Fig. 1).

The easiest method of observing whether or not the adjustment is correct is to elevate the chair until the patient's mouth is at eye level of the operator. Separate the lips with the index fingers of both hands as in figure 6 and a direct simultaneous view will be obtained of both incisal and tooth planes. If in doubt, a Fox-type bite plane indicator may be used to aid selection of correct planes. It is noted that the incisal plane is not adjusted parallel to the inter-pupillary line, because more often than not, this plane is not synonymous with the horizontal plane due to the asymmetrical position of the eyes in a great number of faces.

The centre line is then marked on the bite-rim. Generally this is marked to coincide with the median sagittal plane of the head rather than using the philtrum of the upper lip or centre of nose. Due to the too often asymmetrical placement of the nose and the philtrum of the upper lip, the placement of the centre line in accordance with these structures is frequently bad aesthetically as well as adding to the difficulty of setting the artificial teeth symmetrically in relation to the ridge.

Now ensure that the patient is sitting upright and comfortable with head unsupported. Mark two points on the face, one on the convex surface of the upper lip and the other on a similar surface of the chin. A ball point pen is often satisfactory for this procedure. Request the patient to say the letter "m" a number of times, swallowing after each sound, and allowing the lips to rest together lightly. Repeat this procedure until such time as the distance between the two points is constant when measured by any convenient measuring device (a marked sheet of wax, calipers, etc.). For this patient, and for this series of appointments, this is the vertical dimension for the rest position of the mandible. From this measurement a gauge is made, the length of which is approximately 2 mm. short of the rest vertical dimension. This measurement will be the basic acceptable vertical dimension for the patient unless further tests indicate that it is unacceptable.

Lubricate the bite-rim of the upper base-plate after carving bite-blocks on its occlusal surface in the region of the second bicuspid area, and replace firmly in the mouth. Insert the lower base plate. Check it for accuracy of fit and comfort. Remove the base plate and after heating the occlusal surface of the bite-rim, replace in the mouth and have the patient close together lightly until a position is reached which is identical with the trial vertical dimension previously determined. Request the patient to "let the teeth touch together lightly" several times, and when this can be repeated without lateral deviation of the mandible, the centre line on the upper rim is continued onto the labial surface of the lower rim so that for future records any lateral deviation by the mandible will be readily observable.

Have the patient count from 1 to 10 first slowly then rapidly.[18] Ask the patient to say such words as "Mississippi," "satisfactory," "mother," "fifty-five" and "one thousand." In all these phonetic tests, the bite-rims should not touch, the tongue should be permitted to pass between the anterior part of the rims in the "th" sounds, and exploding "f" sounds permitted by correct relation of the lower lip to the incisal edge of the upper bite-rim. Question the patient as to the comfort of the occlusal position and check the aesthetic effect produced to date with the patient. If the bite-plates meet all the requirements indicated, then the correct acceptable vertical dimension has been estimated. The operator must now record centric relationship, having in mind that such a position is three dimensional.

Techniques vary considerably from here on, but essentially resolve into intra-oral wax records (thermo-set) or intra-oral plaster type

Fig. 6.—Chair height adjusted to eye-level of operator. Lips separated by index fingers give simultaneous view of incisal and tooth planes indicating degree of correction required.

(chemical set) records employing a central bearing pin appliance. The author prefers intra-oral wax records, thus sharing the opinions of Schlosser[19] and Schuyler,[20] who believe that not only are they entirely adequate, but are as accurate in most cases and more accurate in many cases than records taken by any other means.

After the estimated acceptable vertical dimension has been recorded on some measuring device, the head rest is brought into con-

tact with the back of the head (Fig. 7). The head rest is placed in this position not to support the head vertically, but to prevent its distal displacement should the patient involuntarily draw away from the operator when the mouth is approached. Although some operators make the centric registration in the horizontal supine position of the patient[21] or at least in the deeply reclining position[19] it is considered that any position is unacceptable

Fig. 7.—"Wings" of wax or modelling compound attached to lateral surface of bite-rim in 2nd bicuspid-1st molar region, in order to permit digital assistance to stabilisation of bite-plate during centric registration.

except that in which it is intended that the dentures should function. Reverting to the study of the muscles of mastication and other associate muscles, it will be noted that when the head is distally placed, the force of gravity adds as an altered factor to those forces operating when the head is erect, when the force of gravity is a vertical one in relation to the patient, counteracted by the tonus of the elevator muscles of the mandible. The force of gravity is claimed by authors just referred to, to "facilitate" the registration of correct centric by forcing the condyle into the distal portion of the glenoid fossa, whereas in actual fact it cannot be regarded as physiologically normal. In a backward movement of the head, the platysma muscle together with other structures of the neck tends to pull the anterior portion of the mandible downwards and backwards. In this position, the slightest movement of the head from the saggital plane will cause the force of gravity to swing the mandible to the side to which the deviation has occurred and premature contact on closure will occur in the posterior region on the opposite side of the mouth. These facts serve to emphasise again that the infra-mandibular muscles and the force of gravity cannot be excluded in any discussion on the function of the muscles of mastication. Similarly, when the head is allowed to drop forward from its normal erect position, the physical presence of the structures of the neck preclude the recording of centric relationship in an unstrained position.

Another method advanced for facilitating an unstrained centric registration is the "tiring of the muscles of mastication" in order that after they are fatigued a registration of centric will be more readily achieved.[22] After continuous strong exercise, it is not always possible to obtain normal rest position of the muscles for some time, because in most cases, a hypertonicity of the muscles ensues.[7] This casts a strong doubt as to the wisdom of carrying out excessive mandibular movements such as prolonged protrusive movements in an effort to obtain "relaxation."

It must be recognised additionally that chronic disorders of the temporo-mandibular joint, postural muscle reflexes,[10] hypertonicity (as in trismus) and hypotonicity (as seen in fatigue, debilitating diseases and conditions of general diminished tonicity)[15] may all exert sufficient effect as to make the attempt to record a physiological centric registration impossible at this stage of the procedure. It is acknowledged, however, that with the correct vertical opening and the registration of the most distal unstrained position of the condyles possible at the time, it is possible to build dentures which would be satisfactory at the time of insertion. After continued wearing of the dentures which have been constructed faithfully to the correct records, a correction of conditioned reflexes and pathological disorders of the temporo-mandibular joints with muscle re-adjustment may occur. This generally results in a further retrusion of the mandible. This retrusion produces clinically an opening of the bite by premature cusp contact posteriorly. Correct centric can, however, be restored in most cases by occlusal correction provided that the distal displacement of the mandible is no greater than half the mesio-distal width of a bicuspid tooth on the denture.

Fig. 8.—Headrest now adjusted to contact back of head to prevent its distal displacement during centric registration. It is not to give vertical support to head.

If the lower bite-plate is subject to lateral or distal displacement due to an excessively resorbed or flabby ridge, wings of wax or modelling compounds are added to the buccal surface of the lower bite-rim in the second bicuspid-first molar region (Fig. 8) in such a way as to be free of occlusion and permit vertical seating pressure by the index fingers of both hands while the chin is reciprocally supported by the thumbs (Fig. 9).

The process of closing from rest position to centric position is practised by the operator. In a co-operative patient, an instruction is given to "touch the back teeth together gently." With other cases, the patient is asked to relax, and while attention is diverted from the operation the jaws are mechanically closed with a slight tapping motion. With practice, it is possible to detect when the patient is relaxed, and the condyle will be felt to move into the distal portion of the fossa when light pressure is exerted on the point of the chin by the thumb. In some instances, it is wise to prepare the patient by premedication,[16] exercises, and possibly physiotherapy.

The final stage of registration of centric occlusion is now possible. Lubricate the occlusal surface of the upper bite-rim and securely reinsert the upper base-plate. Reduce the occlusal surface of the lower bite-rim 3 mm. all round. Modelling wax is heated in a flame and when softened is rolled on itself until a roll of homogeneously soft wax is made approximately 3 mm. thick. This softened wax is rapidly luted to the occlusal surface of the lower bite-rim in the bicuspid and molar region, leaving the incisor region quite free. The base-plate is quickly placed in the mouth and while retaining it in position as formerly described, with the condyles in their correct position in the fossae, the closure is effected through 1 mm. of softened wax only. The record is removed from the mouth and chilled. It is examined to ensure that the opposing bite-rim has not penetrated completely the softened wax at any point. If this has occurred the record is valueless. It should be discarded and a fresh record taken. Wax cannot be satisfactorily warmed to a uniform consistency of softness by dry heat by using a heated wax-spatula, or even by the flame of an alcohol torch. Even one small area of wax which is not as soft as the other part of the wax record, will cause an eccentric record, as the record will stop at the firmer wax while on the opposing side the force of leverage will force the hard rim further through the softened wax if any pressure is applied. It is for this reason that wax records do not attain the recognition which they deserve. As in many other cases in dentistry, it is not the material which is at fault, it is the method of handling it.

After the record has been chilled, the bite-plate with the record attached is returned to the mouth and the record is checked again with all the data previously obtained. If there is any premature contact or variation from the record previously decided upon, then the wax record is removed completely from the rim and a new record taken.

When it is considered that the recording of centric registration is correct, the bite-blocks are again placed back on the casts and occluded in the centric relation. If there is any obstacle present to prevent this orientation, such obstacle should be removed, and if its removal could in any way interfere with the occlusal record taken, the record should be discarded and a new record taken.

With this centric record and the use of a face-bow, depending on the type of articulator used, the casts are oriented on an adjustable articulator of the operator's choice.

In an overwhelming majority of cases the record thus made is as perfect as conditions will permit at the time. The operator has full control of the procedure, is able to feel when

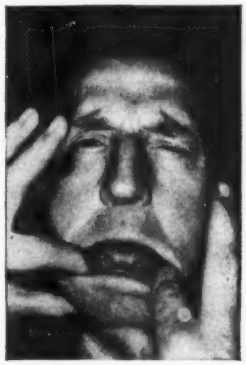

Fig. 9.—Lower bite-plate seated on lower ridge with index fingers supplying slight direct vertical stabilising pressure on the wax "wings" while mandible is reciprocally supported by the thumbs.

relaxation of the masticatory muscles is achieved and condylar retrusion is satisfactory. He is not dependent on the unskilled execution of his orders by a patient who is mostly unpractised in voluntary control of the muscles of mastication and knowingly carries out this pattern of closure.

Where the operator thinks that there may be a discrepancy, which he is unable to detect by other means, it is suggested that where practicable he make use of a central bearing pin appliance registration appliance.

If this method is followed, the procedure already described is not varied up to the stage of mounting the casts on the articulator with wax records. From this point, however, it is

necessary to mount a central bearing pin appliance on the upper and lower base-plates, the lower rim being reduced so that there is no possibility of contact in any lateral or protrusive movement. The bearing pin is adjusted to the recorded vertical dimension. Place the upper rim in position after coating the scribing plate. Place the lower bite-plate in position. Ask the patient to move the mandible forwards and then backwards while keeping his "teeth" together, and then open. Observe the pattern on the scribing plate. If it is a straight line, then re-insert the lower bite-plate in the mouth. Have the patient move the mandible forwards and then backwards. Then ask him to move the jaw to the left side and open his mouth. Repeat this for the right lateral movement. Remove the upper base-plate and examine the Gothic arch traced on the scribing plate. For a satisfactory record the apex of the Gothic arch tracing should be definite, although in some cases, due to an exaggerated Bennett movement, the apex of the Gothic arch tracing is not always a sharp angular point. This procedure is continued, renewing the recording surface each time, until a satisfactory Gothic arch tracing is recorded. The appliance is then adjusted, depending on the type of appliance used, so as to indicate the position of centric relation after the base-plates are returned to the mouth. In this position, the patient is instructed to hold the jaws together lightly, and plaster is inserted between the rims. When the plaster has set, the bite-plates are removed from the mouth and replaced on the articulator, and if found at variance with the previous wax record, the lower cast is removed from the articulator and remounted in accordance with the new record.

It will be noted that reference has only been made to intra-oral Gothic arch tracing devices. For edentulous cases, most modern techniques eliminate extra-oral tracing devices as it is realised that even the small weight of the extra-oral tracing device can be sufficient to cause a displacement of the base-plate even though at the point of application of the tracing pin, the jaws are in true centric relation. The interference with normal lip contact also adds an additional factor which may cause an error in recording.

The procedure of using central-bearing pin appliances cannot be dismissed without attention being drawn to the following facts; this type of appliance cannot be used entirely satisfactorily in either an extreme Class II or Class III type of occlusion. Due to the nature of the appliance, it can only be used satisfactorily when the pin and the centre of the recording plate are exactly in the centre of both arches;[23] in Class II and Class III types of occlusion the difficulty of evenly distributing the occlusal stress during the recording makes these records inferior to well taken intra-oral wax records. Additionally, this type of appliance cannot be used with uncooperative patients, patients with deficient or excessively flabby ridges, or patients of small mental calibre, as frequently patients are physically incapable of doing such apparently simple things as moving the mandible either to the right or left side, of even protruding the mandible at all, or even touching the back of the palate with the tongue when so instructed.

Methods of "chewing in" the occlusal planes of bite-rims[24] are worthy of consideration in certain selected cases, but as these are generally the cases which are more simply dealt with by the method just described, no further consideration of this method will be given in this paper.

There is, however, a compromise between the intra-oral wax recording method and the central bearing pin appliance method, which possibly overcomes the difficulties of both procedures and it is presented as such. Follow out the directions for intra-oral wax recording up to the stage where a centric registration has been made. Then reduce the lower bite-rim so that it is completely out of contact with the upper rim except over an area of not more than 5 mm. on each side in the region of the second bicuspid-first molar where the centric record is retained intact. Re-insert the lower rim in the mouth and ask the patient whether even pressure is felt on both sides. When there is no premature contact on either side and with the bite-rims together in the centric relation and with contact only in the restricted area mentioned, plaster is introduced between the bite-rims in the same manner as for the central bearing-pin appliance method. This record is removed from the mouth together with the bite-plates and the casts oriented on the articulator as previously described.

In the foregoing discussions, it has been convenient in general to consider that the case under discussion was a Class I type of occlusion. In this case, as with all types of occlusion, the occlusal wax record should only cover that portion of the bite-rim on which direct pressure is brought to bear in centric relation. In the Class I type of occlusion, the area covered would be that of the bicuspids and molars only. In other types of occlusion the same principle applies, only in these cases the exact area of occlusal pressure varies. In the Class II cases it may be necessary to record the occlusal contact over the cuspid to second molar area, the first lower bicuspid teeth being frequently omitted from the set-up. In these cases, the occlusal contact may be over a comparatively smaller area, and the need for as great a contact in the posterior region

as possible is evident. In Class III types of occlusion, it is often necessary to set the teeth with an edge-to-edge relationship anteriorly, that is, with incisal contact in centric relation. In these cases, it would then be necessary to record centric relation with the recording wax covering the whole of the incisal and occlusal surfaces.

SUMMARY.

1. The anatomical structures connected with the registration of centric relation have been described, and their function discussed.

2. The physiology of the muscles of mastication has been considered as it affects centric registration.

3. Mention has been made of those factors which render the registration of correct centric relation temporarily impracticable if not impossible.

4. The modern concept of anatomy and kinesiology has been related to techniques for centric registration, and from this consideration, a technique has been evolved which contains the best features of a number of methods, while attempting to eradicate those phases which are considered not to be physiological in concept.

5. As further knowledge is gained regarding detailed anatomy and function of the masticatory mechanism, it will be necessary to review present methods of centric registration. However, at present it is considered that adherence to the technique outlined in this paper will not only prove satisfactory in practically all cases, but at the same time be regarded as a rational approach to recording centric relation in full denture construction.

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Infection of the Maxilla in Relation to Maxillary Sinusitis*

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The type of infection under discussion is usually referred to in the literature as "dental infection." This term, however, is too narrow and not very accurate, for the following reasons.

1. Every untreated infected tooth ultimately produces infection of the adjacent jaw bone. (a) If the pulp of the tooth becomes septic, the bone at the apex of the root becomes infected as soon as the organisms or their toxins pass through the foramina of the root apex. (b) In the case of periodontal disease (so-called *pyorrhoea alveolaris*) the infection is outside the tooth from the beginning, the initial lesion being an ulceration of the surface of the gum which is in contact with the tooth. From there infection spreads into the periodontal membrane, and a rarefying osteitis of the bone of the tooth socket follows.

2. Infection may remain in the bone long after all the teeth have been successfully removed. This occurs in the condition known as residual osteitis and in cysts of various types which have become infected.

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3. Infection of the jaw bone may follow trauma.

Estimations of the importance of this source of infection in the causation of maxillary sinusitis have varied greatly in the past fifty years. At the early part of the present century some writers expressed the opinion that nearly all cases of antrum infection were caused by infected teeth. Twenty or thirty years later most estimates ranged between 15% and 30%. More recently there has been a tendency to discount the connection still further, till at the present time most writers either dismiss the subject in a few lines or ignore it altogether. The writer believes that the pendulum has swung much too far in this direction.

It has frequently been his experience, when performing an antrostomy for the recovery of a tooth root which has been forced into the antrum, to find hyperplasia of the lining confined to the floor of the cavity, or in some cases extending to the nasal wall, while the remainder of the lining is of normal appearance. A similar condition has often been observed during repair of oro-antral fistulae, when it has been possible to view the cavity of the antrum. Both of these conditions, oro-antral fistula and "tooth root in antrum," are usually produced as the unfortunate sequel of a difficult tooth extraction, and the tooth is usually an infected one.

A few years ago it was decided to make a histological study of antral mucosa taken from a number of patients with clinical and/or radiographic evidence of infection of the jaw near the antrum. To date 32 cases have been examined. Three specimens were obtained from a public hospital, where, in the extraction of teeth, part of the jaw bone, including portion of the floor of the antrum with its lining, came away with the tooth. In the remaining cases the specimens were obtained by the following procedure.

A flap of oral muco-periosteum was reflected in order to expose the infected area of the jaw bone. The source of the infection was eradicated and the bone curetted. In many cases a defect was found in the antral wall, part of the antral lining being exposed, and a portion of this was taken for biopsy. In ten of the cases the antral wall was found intact and a small window was cut in the bone and a piece of the lining thus exposed removed for biopsy. Some examples of the histological sections made from these specimens are shown (Figs. 1-4).

Of the various classifications of sinusitis, Swinburne's[1] modification of that of Eggston and Woolf has been found the most satisfactory. He separates simple chronic sinusitis from chronic purulent sinusitis and subdivides the latter into the following types: (i) polypoid, (ii) sclerosing or fibrotic, (iii) glandular or adenomatous, (iv) papillary, (v) atrophic.

If this classification is applied to the cases examined, the type forming about 70% of those examined so far is the sclerosing or fibrotic. In one case the type is glandular or adenomatous, and most of the remainder, from both their history and the histopathology, appear to come under the heading of simple chronic sinusitis.

The surprising result of this investigation is that in every patient examined a diseased antral lining has been found and that many patients have shown gross changes.

The only work of a similar nature which a search of the literature has revealed is that of two German investigators, Zange and Hoepfel. Their work was done on post-mortem material. The original articles in the German literature are not available in this country, but their findings are summarized by Thoma[2] as follows:

> Both state that in jaws containing infected teeth, inflammatory changes in the membrane of the sinus are much more common than is generally believed. They may also occur when the bony wall of the sinus is intact. Hoepfel states that even if a relatively wide bone layer were present, separating the apex of the infected tooth from the sinus cavity, the membrane of the antrum might still show pathologic changes. Similar changes could be established also in the case of deep periodontal pockets. The marrow of the interposed spongiosa in these cases shows an inflammatory reaction, while the antral mucosa is affected by oedema, round celled infiltration, fibrosis, and cystic degeneration. In other cases the apical destruction included the wall of the sinus, the bony defect either being filled with active or fibrosed granulation tissue, or containing a fistula.

All these statements agree with the writer's findings.

The path of spread of infection from the jaw to the antrum is obvious when a bony defect exists in the antral wall. Spread through an intact antral wall is understandable if we remember that the blood vessels which supply the teeth and the bone surrounding them come down through the wall of the antrum.

Strong[3] inserted hypodermic needles into tooth sockets, cemented them in with radiotransparent cement, and injected lipiodol under pressure. He radiographed the specimens and reached the following conclusions: (i) The blood vessels on the outer and lateral walls of the antrum form a plexus. (ii) The vessels to the teeth are in the antral mucosa for the first half of their course, and only in the latter half are they in bony canals—sometimes not even that. (iii) The blood supply to the antrum and that to the teeth are inseparable.

These findings may be linked with the work of Okell and Elliott,[4] who found transient bacteriaemia in a large proportion of cases after the extraction of septic teeth, and in a smaller percentage of cases where septic teeth were

Fig. 1.
Case II: Most of the section shows normal ciliated, pseudo-stratified columnar epithelium. There is considerable infiltration of small round cells, polymorphonuclear leucocytes and a few plasma cells. The blood vessels are engorged and contain abnormal numbers of polymorphonuclear leucocytes.

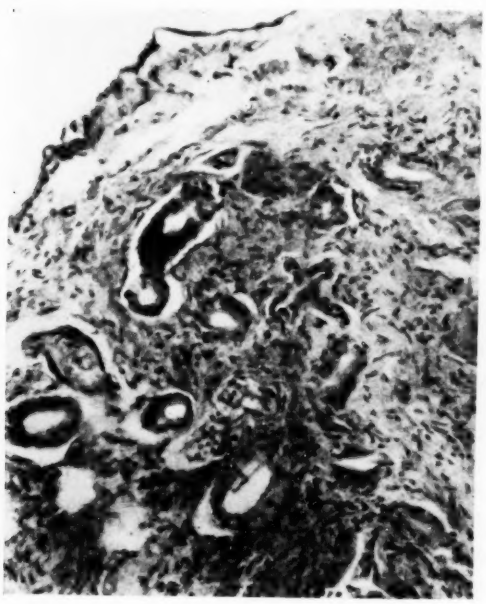

Fig. 2.
Case V: There is complete destruction of epithelium. Most parts of the section contain numerous small round cells and plasma cells. Many areas show fibrotic changes. Degenerated glandular tissue is also present.

Fig. 3.
Case X: The antral mucosa was grossly thickened. There is extensive fibrosis and a moderate amount of infiltration with small round cells and plasma cells. Most of the blood vessels have thickened walls. In this illustration ciliated pseudo-stratified columnar epithelium is present, but most of the lining has no epithelium.

Fig. 4.
Case XXVII: Most of the epithelium lining has been destroyed. Large areas show a weak connective tissue stroma crowded with small round cells and plasma cells. Other areas not shown in this illustration are made up of fibrous connective tissue with comparatively little cellular infiltration.

present after minor degrees of trauma, such as brushing the gums or eating.

If it is allowed that this source of infection is of importance in sinus disease, what can we do about it?

Diagnosis.

A cursory glance around the mouth to see whether any obviously infected teeth are present is totally inadequate. The upper jaw should be carefully examined for less obvious signs and symptoms of infection, such as irregularity of the bone, swelling, tenderness on palpation, expression of pus *et cetera*.

In most cases intraoral radiographs of the posterior part of the maxilla of both sides are absolutely essential. They will disclose the presence of buried root fragments, residual osteitis, cysts *et cetera*, which may defy detection by any other means. Therefore in many cases the co-operation of a competent dental surgeon or a radiologist is necessary from the diagnostic point of view.

Treatment.

The treatment of the jaw infection itself is the province of the dental profession.

1. Extraction of all posterior maxillary teeth with caries involving the pulp should be strongly urged. For many years it has been the opinion of the writer that, while root canal treatment may sometimes be permissible for single-rooted teeth, it should never be attempted for multi-rooted teeth—at least until some more satisfactory methods than those of the present day are evolved. The rhinologist should insist on this point of view.

2. The removal of all root fragments, cysts, areas of chronic osteitis *et cetera* is the work of the dentist or oral surgeon, and must be carried out with great thoroughness. The writer is convinced that these operations should always be done under aseptic conditions, preferably in a hospital operating theatre and with adequate antibiotic coverage.

3. Treatment of the sinus requires the following measures: (i) In many cases the removal of the infected area from the maxilla cures the sinusitis without any further treatment. (ii) In some cases it is necessary or desirable to follow it up with one or more antral wash-outs. (iii) Lately the writer has adopted a third method of treatment for cases in which sinus radiographs show much hyperplasia of the sinus floor, and in which a large opening in the bony wall of the antrum already exists. The hyperplastic mucosa of the sinus floor has been stripped out, the remainder of the lining being left intact. In most of the cases in which this plan has been adopted, washing out the sinus has not been necessary and the post-operative course has been particularly good.

Conclusion.

In conclusion, the writer does not wish it to be thought that he believes this type of infection to be the commonest primary cause of maxillary sinusitis. It may not be the main factor in as many as 20% or 30% of cases, but he is convinced that it is the primary cause in some cases of sinusitis and a contributory factor to the chronicity in many others.

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Some Aspects of Pedodontia Relative to Orthodontia*

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The close relationship between pedodontia and orthodontia cannot be overemphasized for it is the pedodontist who sees the child first and it is he who must assume the task of preventing malocclusion wherever possible and of diagnosing early unfavourable trends in the growth and inter-relationship of dental structures. Lamons[1] states:

> The family physicians of this country and not the specialists are the men most responsible for the health of the people as a whole.

In the same light, the family dentists, or general practitioners of dentistry, and not the men who specialise in some branch of dentistry, are responsible for the health of the oral cavity of the people as a whole. In the prevention of malocclusion the family dentist is the one who must practice prevention rather than the specialist or orthodontist.

In ministering to the dental needs of children the dentist can no longer limit his practice to the filling of teeth showing decay and to prophylactic odontotomy in individual teeth. The practitioners must become aware of the everchanging mouth and jaws in relation to the whole child. He must take into account the sum total of growth and development.

To consider the preventive problem in orthodontics as limited to space retainers and other such appliances is to revert to the mechanistic

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stage of dentistry prior to the twentieth century.

The incidence of malocclusion would be effectively reduced if the general practitioner were able to recognise incipient conditions. As a rule the child reaches the specialist in orthodontics well beyond the point where preventive measures alone will suffice.

Orthodontics as a specialty entails problems which are beyond the usual professional scope of the general practitioners of dentistry and requires extensive specialised training and knowledge but while it is not expected of the general practitioner or pedodontist that he be adept in the diagnosis and treatment of malocclusion he should know whether or not the child requires orthodontic attention, irrespective of the fact that he may or may not be prepared to establish an exact diagnosis and classification of malocclusion or to institute the necessary treatment.

A proper programme of preventive orthodontics requires the ability to appraise normal development and to recognise deviations from normal. It employs all forms of clinical dentistry, therapeutics in the form of myofunctional therapy, and mechanical appliances. It entails the elimination of local habits involving dentofacial structures, the correction of general contributing causes such as incorrect posture and malnutrition, the maintenance of tooth form by proper restoration of individual teeth, timely removal of prolonged retained deciduous teeth, use of space maintainers after premature loss of certain of the deciduous teeth if indicated and reference for treatment of general affections and abnormalities.

The prevention of dentofacial deformities depends on the early recognition of these conditions by the dentist, the rendering of such service as he can and consultation when indicated with the physician, the orthodontist and other medical or dental specialists.

The dentist or orthodontist should not assume final responsibility for the diagnosis and treatment of conditions outside the limits of their respective fields.

The work of the dentist in order to carry out a full programme of preventive orthodontics calls for a complete and thorough examination of all patients and following upon this—

1. The prevention of tooth decay in the light of present day knowledge;
2. The restoration of decayed areas in the deciduous and permanent teeth with a view to restoring their normal forms and to maintain a balanced occlusion, proper function and a healthy periodontium;
3. Controlling the loss of deciduous teeth in accordance with the developmental growth and maturation of the individual child;
4. Employment of preventive aids to promote and maintain normal occlusion, as in elimination of prolonged retained teeth and supernumerary teeth, space retention and correction of harmful habits;
5. Reference to physician and medical specialist for diagnosis and treatment of systemic conditions with dentofacial correlation.
6. Reference for surgical treatment, elimination of clefts of the lips and palate and other conditions requiring oral surgical intervention;
7. Appraisal of developmental processes from the standpoint of the teeth, jaws and the face by means of casts, radiographs and other standards of development and growth and reference to the orthodontic specialist of cases showing manifest maxillary and mandibular deformities, congenitally missing, supernumerary, malaligned or impacted teeth and other orthodontic disturbances.

1. I would like to emphasise the opportunity the pedodontist has, if he sees the child early, of advising the parents in the correct procedures of oral hygiene and diet for the prevention of tooth decay.

2. Filling of deciduous teeth is itself one of the most effective methods of preventing malocclusion. Carious teeth make possible the tipping of adjacent crowns of teeth. Interproximal fillings should be prepared and completed on the same day if possible, Willett[2] advises. Interdental space, whether due to caries or cavity preparation will tend to close rapidly, disturbing mesiodistal relationship. No mechanical space maintainers can be as satisfactory as a normal deciduous tooth.

3. Controlling the loss of deciduous teeth in accordance with the developmental growth and maturation of the individual child. A well-recognised cause of malocclusion is the overlong retention of deciduous teeth. It is obvious that timely extraction of these teeth is one method of practising prophylactic orthodontics. To determine the approximate time to extract deciduous teeth the following should be considered:

(a) Chronological age of the patient. The average age at which permanent teeth erupt is well known. Normally the deciduous teeth should be exfoliated just a few days or a few weeks before the eruption of the succeeding permanent teeth. The difficulty connected with the use of the chronology of the dentition is that it represents average ages of eruption. It is dangerous to apply averages to the individual.

(b) Clinical findings. Observe the teeth that are present in the other three comparable quadrants of the dentition to know whether the tooth in question is being over-retained.

For example when there is uncertainty whether a deciduous molar is being retained too long it can be dispelled if the clinical examination reveals that in the other three comparable quadrants the deciduous molars are exfoliated and the succeeding permanent teeth are erupted.

(c) Radiological findings: If the radiographs reveal that the calcification of the roots of the delayed unerupted permanent tooth has progressed as far as halfway to completion, the overlying deciduous tooth should be extracted to give the permanent tooth an opportunity to erupt. Or, if the radiographs show that resorption of the roots of the deciduous teeth is complete on one aspect of a root, or one root of a multirooted tooth, the ectopic relation of the permanent tooth should be recognised and the deciduous tooth extracted.

Radiographs are indispensible in making a diagnosis in most of these cases, because even though the chronological age of the patient and clinical findings may suggest that the deciduous tooth is being overretained there always are the questions of the presence or absence of the succeeding permanent tooth, the amount of root resorption of the deciduous tooth and the degree of calcification of the permanent tooth to be answered.

(d) The probable results of the extraction of deciduous teeth should be carefully considered, for example, extraction of deciduous canine to relieve crowding in the permanent incisor region is rarely indicated. The complication that arises out of this procedure is one born of the short-sighted policy of extracting two teeth to make room for the eruption of one. If the deciduous lateral and canine are extracted to make room for the erupting permanent lateral incisors a further complication must be faced when the permanent canine begins to erupt. There will be insufficient room for the canine because of the distal drift of the lateral incisors and the mesial drift of the deciduous molars. Hatfield has aptly referred to this practice as "robbing Peter to pay Paul."

Exception to the preceding statement is to be found in those cases in which careful measurement reveals such a deficiency of base bone that later loss of permanent teeth is inevitable. In this case the deciduous canines may be extracted to allow alignment of the permanent incisors. The first premolars are extracted immediately upon eruption to make space for the permanent canines. Following the lead of Hays Nance,[3] careful measurement may reveal that there will be ample room for the permanent teeth between the first permanent molar and the lateral incisor, in which cases the canines may be extracted and a preventive lingual arch placed when the roots of the second deciduous molars are nearly resorbed or when the erupting permanent canines and first premolars need space. Cases falling in this category may be helped by extracting mandibular canines and then deciduous molars before the time of their normal exfoliation, if the preventive lingual arch is used and provided the occlusal relationship of the first permanent molars is correct.

Extraction of the deciduous tooth is an immediate indication when the permanent successor is erupting. It is not good practice to permit a deciduous tooth and its permanent successor to be in evidence in the mouth at the same time. There is no evidence to support the belief that there is some advantage to be gained by leaving deciduous teeth in the arch beyond the time that their permanent successors have erupted. On the contrary all orthodontists have observed cases of malocclusion that had their origin in the overlong retention of deciduous teeth. In view of this fact it is difficult to find justification for the policy of leaving mandibular deciduous incisors *in situ* when their permanent successors are erupting lingually. The advocates of this practice mistakenly expect the retained tooth magically to stimulate growth in the incisor region.

4. Employment of preventive aids such as elimination of prolonged retained teeth and supernumerary teeth, space retention and correction of harmful habits.

Extraction of prolonged retained deciduous teeth has just been referred to but mention must here be made of the necessity for the timely extraction of "submerged" deciduous teeth. These so-called submerged teeth are ankylosed. The ankylosis between the root of the deciduous tooth and the alveolar process will often prevent normal exfoliation or, at best, delay it. The only reason for retaining these teeth is a negative one because generally speaking no problem of space maintenance has to be faced while the ankylosed deciduous tooth is present.

These teeth are worth little more than space maintainers because they are always short of the normal occlusal plane and since they are out of occlusion are of negligible functional value. The most prudent management of these teeth lies with careful observation of the case. If the teeth do not become too extremely submerged they may be kept until clinical and radiological evidence indicates that their removal will be followed by prompt eruption of the succeeding permanent tooth.

If observation shows that the ankylosed teeth are being engulfed by the continuing vertical growth of the adjacent teeth and their processes, extraction is immediately indicated. Whether a space retainer is needed following

extraction depends upon the area involved, the proximity of the permanent successor to eruption and the tendency of the space to remain open or to close.

Supernumerary teeth should be extracted whenever and wherever found. The case is rare indeed where sufficient room is present for an extra tooth without seriously interfering with the development of normal occlusion. Supernumerary teeth are easily detected when present and erupted. Their existence should always be suspected in those cases in which deciduous central incisors are retained too long or where permanent maxillary incisors are late erupting. Radiographs are essential in making a diagnosis.

There are two ways in which supernumerary teeth may cause malocclusion, first, by eruption their presence in the dental arch crowds adjacent teeth out of their normal positions; second, by noneruption they cause the impaction of permanent teeth, particularly maxillary incisors, or deflect permanent teeth by exerting pressure against them during the time they are erupting or after they have erupted.

The consistency with which these teeth cause trouble should make it evident that the operator who finds them early and extracts them promptly is rendering a genuine prophylactic service.

Space retention.

If there is one prophylactic technique that is potentially capable of doing more good than any other it is that associated with preventing undesirable shifting of permanent teeth following premature loss of deciduous teeth.

An unbiased appraisal of the need for space maintaining appliances following the premature loss of deciduous teeth would bring out the fact that mechanical space retention is not always a requisite because spaces may

(i) Open
(ii) Close
(iii) Close initially, open later or
(iv) Remain the same.

In the practice of preventive orthodontics we are primarily concerned with the spaces that close.

Prevention of space closure beyond safe limits can be managed by the use of space-maintaining appliances. Weber[4] suggests that retainers be used whenever the first permanent molar shows a tendency to move more than 1.7 mm. in the mandibular arch or 0.9 mm. in the maxillary arch.

This is an arbitrary method of determining the indication or contra-indication for maintaining space and will result in the use of space maintainers in some cases where they are not needed, but in this matter a few errors would be less damaging than the many omissions that are committed daily. A safe general rule would be the measurement of the space monthly and use of a space maintainer if any measurable closure occurs.

Harmful oral habits.

The therapy of habit eradication is most effective when applied at an early stage. There are many different kinds of oral habits which are potentially destructive to the development of a normal dentofacial complex.

Among the more common are:

(i) Sucking habits: thumb and finger sucking, lip or cheek sucking.[5, 6]
(ii) Biting habits: lip biting.
(iii) Swallowing habits: tongue thrusting.
(iv) Mouth breathing.

Thumb and finger habits are the most common of all oral habits. Most infants suck their thumbs or fingers. In some cases the sucking act is carried to excess and is not discontinued, as is usually the case, by the age of two years. The persistence of the habit beyond the time of eruption of the permanent central incisors is often attended by malocclusion.

The infant or young child whose experience with others in the social group is predominantly characterised by frustration of normal activities and interests by repeated experiences of pain or unpleasantness, as in too much adult regulation and too little freedom to satisfy the activities characteristic of a particular stage of growth, tends to withdraw from and to avoid such social contacts. Some children may refuse to chew or chew weakly and expectorate solid particles. The food may be retained in the mouth for long periods. The child seeks refuge in known sources of pleasure and satisfaction. Such repressions are commonly accompanied by more or less temporary periods of thumb-sucking activity.

Mental hygienists have consistently maintained that direct interference with the sucking activity during infancy is unnecessary, harmful to the normal psychobiologic development of the child and probably the best means of ensuring the continuance of thumb-sucking activity. They have consistently advised against direct interference with a developed "habit" of thumb-sucking in the pre-school period. For the infant this means that no mechanical devices of any sort should be used; there should be no taking or pulling the thumb out of the infant's mouth or show of disapproval or concern; there should be no punishment of any sort for the pre-school child; in addition to the above there should be no ridiculing, criticism or shaming. In the younger child the constructive education of the parent is the clue to discontinuance of the habit. Intelligent attention must be given to the following principles:

(i) Promote the favourable contact of the child with its immediate environment.

(ii) Provide play materials suited to the child's stage of development.
(iii) See that the child has opportunity and space to be active, to experiment, to explore and to play.
(iv) Reduce unnecessary regulation of the child and provide as much freedom as possible.
(v) The home atmosphere should be one of happiness, sympathy, patience and understanding.

Older children can be expected to co-operate more in the breaking of a habit and often a careful explanation of the consequences and an appeal to the child for co-operation may be successful.

A therapy for habit breaking was suggested by Dunlop.[7] He named it the "Beta hypothesis." The habit to be corrected is intentionally practised and the child forced to concentrate on the performance of the act all the time he is practising it. The effect of this is to take the satisfaction and pleasure out of the habit and eventually associate the practice of it with unpleasant reactions, when the habit will be abandoned. Obviously this therapy can only be applied to older children where co-operation can be obtained.

Lip-biting habits may be destructive to normal occlusion. The lower lip is the most frequent offender and protraction of the maxillary incisors can be caused by this habit.

Perverted swallowing habits are often manifested as tongue thrusting. This is often observed in an anterior open-bite type of malocclusion. It is usually not observed until after the damage has been wrought but corrective treatment will not be a lasting success if the tongue thrusting habit is unbroken.

Treatment of dentofacial habits by means of mechanical appliances may be undertaken in the older child.

Interference with suction created in the sucking habit will eventually lead the child to lose interest in and discontinue the habit because of the elimination of the pleasurable effect. Heimlich[8] has suggested an appliance based on this fact and Swinehart[9] has devised an appliance whose prongs interfere with the suction between the fingers and palate. A similar appliance with spurs may be devised to check lipsucking, lipbiting and tongue thrusting.

Mouth breathing may be difficult to eradicate, and the first step should be to establish a clear airway. If there is any doubt the child should be referred to a rhinologist for examination.

One of the most useful ideas is to tell the child to exercise frequently throughout the day until out of breath and then close the lips firmly and breathe only through the nose.

Use of an oral screen may be desirable in some cases.

Preventive orthodontics are well served when the alert dentist detects these or other pernicious oral habits and applies the therapy that can effect their discontinuance.

5. Reference to physician or medical specialist for diagnosis of systemic conditions with dentofacial correlation whenever suspicion is aroused in this regard.

6. Reference for surgical treatment, elimination of clefts, etc., would usually have been attended to by the family physician before the dentist sees the case but should obviously not be omitted.

7. Appraisal of the developmental processes from the standpoint of the teeth, jaws and face by casts, radiographs and other standards of development and growth and reference to the orthodontic specialist of certain cases.

It is this last field which is too often overlooked that I would like to draw to your particular attention, that is the study of any unfavourable trend in development that will lead to more serious malrelation of dentofacial structures if left untreated. Too often we find that some unfavourable development that could have been checked early is allowed to progress to a stage where extensive treatment becomes necessary.

In the normal child two types of occlusion in the deciduous dentition have been described which may be regarded as normal:

(a) Distal surfaces of maxillary and mandibular deciduous second molars are in the same vertical plane.

(b) Deciduous molars follow the same relationship as is found in normal occlusion of permanent molars, the mesiobuccal cusp of the upper second molar occluding in the buccal groove of the second mandibular molar.

In the common deciduous dentition at the age of 3-4 years there may be a deep overbite in the incisor region.

By the age of 6 or 7 the teeth have worn and the first permanent molars are erupting. Quite often a cusp to cusp relation of these teeth is observed for frequently, as stated above, the distal surfaces of deciduous second molars are in the same vertical plane.

This occlusal relation of the permanent molar is normally altered at the time the deciduous molars are replaced by premolars. Since the mandibular deciduous molars are larger than the maxillary molars the mandibular permanent molar has room to shift more anteriorly than the maxillary molar and so the eventual relation is that of mesiobuccal cusp of the upper in the buccal groove of the lower, first permanent molar.

In the case of premature loss of upper deciduous molars there is a grave risk of mesial drift of the upper permanent molar

and a subsequent Angle Class II relationship being established. Should this occur immediate treatment is desirable.

From the time of their eruption up to the age of about nine years the mandibular permanent incisors are usually crowded. They often erupt in positions lingual to the line of occlusion and minor irregularities in the relation of these teeth should not be considered as evidence of malocclusion until after the eruption of the permanent canines. To do so overlooks the fact that the intracanine width of the mandibular arch is not maximal until after the age of 10 years and that, with its width dimension increasing, more space is made available to the crowded incisors. Given the required space the incisors will often correct their positions, assisted by the moulding action of the muscles of the tongue and lips.

At the age of 7-8 years space between the maxillary permanent incisors is not unusual or abnormal. Such a diastema may close or persist with eruption of the permanent lateral incisors. There is no cause for concern about this space until it is evident that the wedging action of the erupting maxillary permanent canines will be insufficient to close the diastema.

The maxillary frenum labium is often unjustly blamed for spaced central incisors. As Dewel[10] has pointed out there are other factors to consider such as "tongue pressure, lip habits, closed bite and pegshaped or absent lateral incisors" because they may "also cause separation of anterior teeth."

Between the ages of 9-11 years also, axial perversions of maxillary lateral incisors are often observed. Pressure from the crowns of the unerupted canines against the distal aspect of the roots of the lateral incisors accounts for these changes. As the canines with their eruptive movement travel towards the incisal plane the crowns of these teeth subsequently reach a point where they no longer contact the roots of the laterals. When this stage is reached the laterals usually begin to make adjustments in their relations which eventually bring them back to ideal positions. The denture of the patient thus passes through what Broadbent[11] calls the "ugly duckling" stage.

Deep (not excessive) vertical overbite may improve up to the age of 20 years. The depth of the vertical overbite is subject to constant change. At the age of 2 to 3 years the vertical overbite in the deciduous dentition is deep in comparison to that found at 5 years. At this age the overbite may be slight or absent. With the eruption of the permanent incisors the vertical overbite again becomes deep. Its depth lessens gradually as the deciduous molars are exfoliated and the premolars erupt. The depth of the overbite will normally continue to diminish until the age of 18-20 years when vertical growth of the jaws is completed.

Treatment of dentofacial anomalies before the sixth year should not be concerned with malpositions of single teeth unless they interfere with the function and continued development of the arches. Treatment in the deciduous dentition should concern itself with anomalies affecting groups of teeth, the relationship of the jaws to each other and to the cranium and face. Treatment eliminating the active agent responsible for the development of malocclusion is frequently sufficient to bring about self-correction. Conditions inimical to the continued development of normal occlusion which obviously cannot correct themselves should be treated as soon as diagnosed. Anomalies demanding immediate reference to the orthodontist for treatment include:

1. Gross dental arch malrelation and malformation:
   (a) Class I cases where maxillary incisors occlude lingual to the mandibular.
   (b) Class II cases whose definite jaw relationship is involved.
   (c) All Class III cases.
   (d) Severely crowded deciduous arches after some observation of the progress of natural growth.
2. Prevention of closure and opening of closed spaces after premature loss of deciduous teeth.
3. Crossbites.
4. Openbites.
5. Deep or extreme overbite in which the soft tissues are harmed.
6. Habits involving dentofacial areas.
7. Individually malposed or supernumerary teeth when in malocclusion and interfering with function and normal arch growth.
8. Prolonged retained deciduous teeth have already been discussed.

Reviewing what has been said one fact clearly emerges. Occlusion is not a static but a dynamic phenomenon. Its development is inextricably associated with growth of the jaws, face and cranium. Just as these structures are in a constant state of flux during the early years of an individual's life so too are the teeth changing in their relations to these parts and to each other.

In recognition of this, Hellman[12] states: Diagnosis of occlusion really becomes diagnosis in development.

It is, therefore the duty of all general practitioners to be ever alert for the unfavourable growth trend, for treatment at an early stage, according to Eby,[13] possesses a preventive as well as a corrective value for it eliminates

functional interference and corrects abnormalities in the trend of growth.

In conclusion, I quote Dallas McCauley who writes:

First we would contrive to promote the programme of the pediatrician, to guard over the general physical health of the child during the first twelve or thirteen years of life. Secondly, we would use all possible means to promote the most favourable environment for the growing face and denture. This would include maintaining optimum health of the primary teeth and correction of all local factors known to produce imbalance of developmental forces.

This is, in its broadest sense, the duty of the pedodontist who wishes to give full service to his young patients.

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Copper Amalgam in Children's Dentistry*

PART I.

Bruce Lindsay, M.D.S. (Adel.).

In advocating the use of copper amalgam it is necessary to go against conservative dental opinion as expressed by Scharfenburg[1] who maintains that this material does not belong to children's dentistry, but there are sufficiently good reasons.

Why is it so consistently condemned? In time the general mistrust eventually convinces us that there is no sound basis for using it.

*Lecture delivered at a general meeting of the Australian Dental Association (N.S.W. Branch) on 26th August, 1952.

However, try and find out why it should not be used; some writers say it should not be used but do not give many sound reasons. The basis of the objections to its use appears to be that after packing in a cavity it is of an extremely plastic consistency for many hours, and that when set it is a soft material relative to silver amalgam.

It is very difficult to find worthwhile references in the literature to copper amalgam, particularly any concerning its physical properties.

Campbell Smith[2] gives to copper amalgam the merest mention:

Copper amalgam is said to have germicidal properties. It may have a greater hardness than silver tin amalgam, it is inclined to shrink during hardening, and is easily attacked by hydrogen sulphide or soluble sulphides, giving a black discolouration which affects the tooth substance. It is also liable to corrosion, and for these reasons its dental use is limited.

Here is the usual condemnation, but at least he does admit there is some use for it in dentistry.

Skinner[3] says:

It is used mainly in restoring deciduous teeth where it is of some value because of its bacteriostatic effect due to its slow solution in the mouth fluids. Also copper amalgam hardens slowly, requiring from 8 to 12 hours. Once it is hardened its crushing strength is satisfactory, and it exhibits no flow whatsoever when it is mixed as are the silver amalgams.

Hogeboom[4] says:

G. V. Black made extensive studies in amalgams and the following thoughts are based largely on his works. His examination showed that copper amalgam fillings generally retain good margins when they are once made good, better or more perfect than any other plastic material. He reported that copper amalgam does not flow, it suffers no change of form under stress except to crush to atoms. After it has once fully set, its form cannot be changed by stress at all. Within the limits of its strength it is rigid as steel, it will fly to pieces but it will not bend nor compress. As a filling material it is absolutely rigid.

The Advantages of Copper Amalgam as a Filling Material.

1. It is more easily tolerated by the pulp than any other permanent filling material.
2. Being a reversible amalgam it is economic and there is a minimum of wastage, as all excess can be re-used.
3. Its bacteriostatic effect.
4. Its slow solubility helps to prevent recurrent caries as marginal deficiencies are filled with black copper oxide.
5. Its hardness when set is of a consistency of that of silver amalgam.
6. It exhibits no flow whatever compared to silver amalgam, which may have a permissible flow of up to 4 per cent.

Disadvantages of Copper Amalgam.

1. Slowness of setting, which at the same time produced difficulties of manipulation. To the author, this appears to be its only real clinical disadvantage. The rate of setting varies with the manner of manipulation and the consistency at which it is packed in the cavity.

2. Its slow solubility in the mouth.

It has been claimed that a mesial restoration in a first deciduous molar will damage the permanent canine if the latter erupts an appreciable time before the deciduous molar is shed, because the copper amalgam restoration will provide such a poor contact with the canine that food will lodge, and decay the canine. This is a purely hypothetical objection because these adverse results seldom occur in actual practice. A distal cavity in a permanent canine or first premolar while in contact with an unshed deciduous tooth is very rare.

The solubility of copper amalgam in the mouth varies considerably with the consistency at which it is packed in the tooth.

There are other disadvantages such as the poor colour, which are of little consequence when we are considering the material as a means of restoring deciduous teeth.

As the two major disadvantages vary with the method of manipulation, this matter is important and must be discussed.

Manipulation of Copper Amalgam.

Before packing in a cavity, two things are essential, as with silver amalgam, viz.,

1. A properly prepared cavity.
2. A firm matrix in Class II cavities.

Cavity Preparation.

There is no need to discuss this at any length as many excellent papers are available in the current literature on the subject, including one by Jones.[5]

It is very difficult to prepare the proper type of cavities for copper amalgam without using local anaesthesia.

Cavities must be cut according to Black's classic principles with certain modifications because of the peculiarities in anatomy of the deciduous molars.

(a) Extension for prevention is essential to prevent future caries, particularly at the buccal and lingual cavo-surface angles in Class II cavities.

(b) All caries should be removed, except when some is deliberately left to prevent pulp exposure.

(c) Class IV cavities should be made very wide at the junction of occlusal and proximal portions; this part should be cut finally to the width of a number 8 inverted cone bur, as otherwise failure of restorations at the axio-pulpal line angle will not be uncommon.

The Matrix.

A poor fitting matrix is the main cause of failure in Class II amalgam restorations in deciduous molars.

The use of an inaccurately adapted steel band wedged between the teeth as a matrix would render it impossible to condense amalgam along the buccal and lingual cavo-surface angles of the proximal portions, and fracture and disintegration would probably occur.

A close fitting and rigid matrix is essential, and the Ivory No. 8 is very simple to use on deciduous molars. It can be closely adapted to the tooth, and screwed tight, so that it is firm and rigid with little likelihood of displacement.

A bicuspid band should be used and the margins trimmed. By using two matrices it is possible to have one always ready. One would be used on upper right and lower left molars: the other on upper left and lower right molars.

Mixing the Amalgam.

The amalgam is heated at the lowest possible temperature for the shortest time required to produce sweating. In this way contraction is kept at a minimum.[6]

As much excess mercury as can be expressed with finger pressure is then removed, and a very small amount placed in the bottom of the cavity; or in a proximal cavity, at the bottom of the step. The amalgam is then "dried" in a double thickness of gauze using strong finger pressure. The cavity is then slowly filled with this hard amalgam, and any soft amalgam that reaches the surface during condensation is removed. The cavity is overfilled until the top layer of amalgam is hard. Before removing the matrix the excess is carved away to a degree that the operator feels will leave the amalgam free of the occlusion. Experience soon enables one to do this to such an extent that the filling is usually free; if necessary the opposing cusps can be disced away with a diamond disc or stone.

The matrix must be removed carefully, as any damage caused here may not be seen at the time and can result in a broken filling. It is best to free the matrix from the band and then remove the band with a bucco-lingual motion.

If the filling lasts for the next five or six hours, it will last as long as any silver amalgam restoration, as far as the deciduous teeth are concerned.

Discussion.

Several advocates of the use of copper amalgam have expressed the following opinions:

Martin[7] says,

> As a filling material for deciduous teeth copper amalgam is most useful, economical and practical. When used as a filling material, enough copper salts are deposited so that caries seldom recurrs on a broken margin.

and Jordan,[8] amongst several advantages she claims for copper amalgam, lists these two:

> 1. It may be used where thorough dryness of the cavity cannot be obtained.

2. It may be placed nearer the pulp without causing its death than any other material.

This latter is its greatest advantage, and it is the author's opinion that *no* copper amalgam restoration, in any deciduous or permanent tooth no matter how deep, provided there is not an actual pulp exposure, needs any lining of any type.

This, of course, conflicts with a fundamental idea that metallic fillings must be lined for lessening thermal conductivity.

Thus Jones[5] says,

Any metallic restoration, placed in close proximity to the pulp without insulation with lining, will cause death from thermal conductivity.

The author's clinical experience with many thousands of copper amalgam restorations shows that this is not correct. At the present time many of these teeth are being shed, after having these restorations in them for five years. (Fig. 1.)

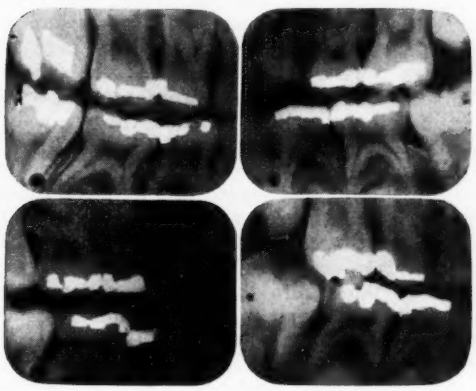

Fig. 1.—Unlined Class II copper amalgam restorations in deciduous molars.

If any deciduous cavity can be filled with copper amalgam without a lining it is obviously a great advantage.

1. It eliminates the time required to line the cavities, which is not inconsiderable in a four or five year old child.

2. The anatomy of deciduous teeth often prevents the preparation of adequate undercuts and a lining detracts from strength and retention of the restoration.

The reasons which support this claim must be examined.

Why is it necessary to line silver amalgam fillings and what follows the omission of the planing?

Many cavities filled with gold foil are quite extensive and yet are not lined. The same can be said about large inlays, as there is often only a fine layer of cement beneath them; not enough to stop thermal changes from injuring the pulp, when considered with the much thicker layer required under a silver amalgam filling.

Now if there is agreement that gold and copper amalgam fillings do not need lining and silver amalgam fillings do, then another reason other than the thermal one must be sought. If a silver amalgam filling is not lined, or even if there is not enough lining, what is the result? Often about eight days after the filling is inserted the patient will complain of sudden attacks of acute pain in the tooth, and at the same time may complain that the tooth reacts to thermal change. If the pain is of purely thermal origin surely it should be noticed on the first occasion on which hot or cold comes in contact with the filling, not eight days later. These attacks are usually relieved by a salicylate, and if they can be borne, disappear after a few weeks. If the filling is very deep the tooth continues to react to hot and cold.

The striking fact about the pain is that its onset is quite haphazard. It attacks at any time, more often than not when the patient is not eating, so that it is not necessarily related to thermal changes. If the filling is removed and a thicker lining inserted, or even better, if a zinc oxide and eugenol lining is used, the pain no longer appears.

Schoonover, Souder and Beall[9] supplied the answer in their work on the expansion of dental amalgams.

Silver amalgams have an initial beneficial expansion of eight microns per centimetre in the first twenty-four hours. A period of from two to seven days of apparent dimensional stability usually exists between the initial expansion and the beginning of the delayed expansion. Excessive expansion as great as three to four hundred microns per centimetre have been measured.

These workers showed this excessive expansion only occurred when amalgamation took place in the presence of moisture. The cause of the large expansion was pressure exerted by hydrogen within the amalgam. This gas is produced by galvanic action between the zinc in the alloy, and water. Non-zinc alloys do not produce this expansion. Calculation of the pressure exerted by the hydrogen within the amalgam found it to be of the order of two thousand pounds per square inch. The period of inactivity prior to the beginning of excessive expansion is accounted for by the fact that during this period the gas pressure is insufficient to cause the amalgam to flow.

They give the following results at the conclusion of their paper:

1. Delayed expansion of amalgam containing zinc is caused by a chemical reaction between the amalgam and water, accompanied by the evolution of hydrogen.

2. The moisture may be introduced by:
(a) Palming in a moist hand.
(b) Triturating or placing amalgams which are sufficiently cold to cause water to condense on it.
(c) Accidental contact with saliva.
(d) Placing amalgam in a wet cavity.

3. The practice of mulling amalgam is bad unless great care is taken to cleanse and dry the hands.

4. Non-zinc alloys do not exhibit any tendency to expand excessively if they are contaminated.

Here is the big difference between silver and copper amalgams as far as the effects on the pulp are concerned. Copper amalgam has a small ultimate contraction, whereas silver amalgam has a large ultimate expansion unless a very exact technique is used during mixing and insertion, to exclude all moisture.

This large expansion irritates the pulp, and produces sudden attacks of violent pain, and the unhealthy pulp reacts to sudden temperature changes. Those teeth which react permanently to hot and cold are teeth containing silver amalgam fillings which have brought about pathologic changes in the pulp, by this excessive pressure. No other type of metallic filling, lined or unlined, produces this effect. However, if the thermal conductivity of copper amalgam was considerably less than that of silver amalgam, this would be a possible explanation of the lack of pain under copper amalgam as a result of thermal shock.

Thus Easlick,[10] an opponent of the use of copper amalgam, states:

> The basis for the claim that copper amalgam can be placed nearer the pulp than any other filling material seems to be the assumption that its thermal conductivity is much less than that of silver amalgam. No one has worked out and published metallurgical tables to show the co-efficient of heat conductivity of this material. The conductivity of both copper and silver as metals is high and of the same order; that of mercury is quite low. One cannot estimate the comparative co-efficients of the two amalgams on the basis of the combining proportions of each with mercury, since both form new metallic compounds when alloyed with mercury.

The writer has made some attempt to find how the thermal conductivity of silver and copper amalgams compare. Cylindrical specimens of both were prepared (about 3" x ¼"). They were turned down to be of equal dimensions. It was found that the length was too short to get accurate measurements of temperature changes. However, they were tested for electrical resistance and silver amalgam was found to have a 70% higher electrical resistance than copper amalgam. This means that copper amalgam is a much better electrical conductor than silver amalgam. Now electrical and thermal conductivity are in proportion for the pure metals, but not necessarily for the compounds formed at amalgamation. However, from these facts* it would be quite safe to say that copper amalgam is a 50% better thermal conductor than silver amalgam.

A projected experiment is to measure the thermal conductivities directly with larger specimens.

If this reasoning is correct it should be possible to place unlined silver amalgam fillings in teeth, using a moisture-excluding technique, and obtain the same result as with copper amalgam. The author decided to do this two months ago, and so far has placed one hundred and five such fillings. It was necessary to proceed slowly, because although it appeared sound in theory, it may not have worked out in practice and the idea of cutting out too many aching amalgam fillings was not one to be relished. At first only one such restoration was done in any one patient and they were limited to Class I cavities in six year molars. All cavities were cut under intra-osseous anaesthesia, all grooves and fissures were included in the cavity, and the cavities were cut well down into the dentine. This insured that there were many freshly cut dentinal tubules, so that the teeth had every chance to react.

The amalgam was removed from the mortar with a spatula and placed in a sheet of rubber dam for mulling. At no stage was it touched by the fingers. Rubber dam was placed on the tooth before inserting the amalgam.

After the eighth day had passed with no complaints I began to cheer up and get more venturesome. After some little while the rubber dam was omitted on occasions and only cotton rolls used and also Class II cavities, including deciduous teeth, were included in the technique.

As yet not one patient has complained.

The following cases are typical ones.

A child aged seven years three months, whose previous restorations were done in copper amalgam, had two Class II cavities cut, and filled with silver amalgam unlined. (Fig. 2.) She has never complained, and can chew ice on the fillings.

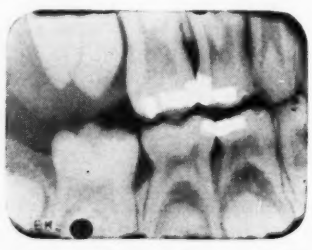

Fig. 2.—Class II silver amalgam restorations unlined, inserted with moisture excluding technique.

*Personal communication from the Department of Electrical Engineering, University of Adelaide.

A young woman needed a number of fillings, including an M.O.D. in an upper right five. This was very deep and a near pulp exposure on the mesial. It was filled with silver amalgam unlined. For six days it reacted for about one second when cold water touched it while she cleaned her teeth. Since then she has felt nothing. This tooth has been tested recently with an electrical pulp tester and

Fig. 3.—Radiogram of upper right second bicuspid showing unlined M.O.D. amalgam restoration, with a near pulp exposure on the mesial.

found to react at twelve volts. Six other teeth in this patient's mouth react at the identical voltage. (Fig. 3.)

SUMMARY.

1. No pain is ever felt under copper amalgam fillings no matter how close to the pulp. Linings are unnecessary.

2. Pain is frequently found under silver amalgam fillings and those teeth may react to thermal changes.

3. Copper amalgam is a better thermal conductor than silver amalgam.[11]

4. The pain under silver amalgam is due to pressure resulting from secondary expansion. This pressure causes pathologic changes in the pulp which then responds to thermal changes that would cause no reaction in a healthy pulp.

5. Silver amalgam if inserted with a moisture excluding technique, need not be lined, irrespective of the depth of the cavity.

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11. Prime, H.—Private communication.

Dental Materials

*Current Notes (No. 17)**

CEMENTING INLAYS WITH SELF-HARDENING RESIN.

There have been several enquiries recently regarding the use of self-hardening restorative resins for the cementing of *gold inlays* and crowns. It is possible that this may have its advantages but it is recommended that the technique be regarded as an experimental one until further clinical and laboratory data are available.

The facts as they stand at present are discussed in these notes, and in giving them the properties considered desirable in a zinc phosphate cement are taken as a basis. The requirements for a satisfactory zinc phosphate cement as listed in Australian Dental Standard No. T3 are:

Setting time: 4 to 10 minutes.

Compressive strength: Not less than 12,000 p.s.i.

Film thickness: Not more than 0.040 mm.

Solubility: Not more than 0.30%.

Applying the same method of testing *setting time* to self-hardening restorative resins the results obtained usually fall within the range of 4 to 10 minutes after the commencement of mixing. This means about 2 to 8 minutes after insertion, but this may vary according to the manufacturer's instructions for mixing and the use of modifying agents supplied with some self-hardening resins.

The *ultimate compressive strength* of commercial plasticised acrylic sheet is given as about 12,000 p.s.i., which corresponds to the specified limit. Unplasticised dental resins would give higher figures if sufficiently polymerised, which may not be a valid assumption for the self-hardening resins.

*Contribution from the Commonwealth Bureau of Dental Standards.

Tests for the *film thickness* show that, under the specified load which corresponds to about 100 p.s.i., the restorative resin mixtures squeeze out to a film of 0.08 to 0.10 mm. This is over twice that allowed for zinc phosphate cements, and is one of the chief reasons why caution must be exercised in using the present self-hardening resins for cementing inlays. It is possible that specially fine powders could be introduced to meet this requirement.

The *solubility* indicating the liability to disintegration in oral fluids is much lower for acrylic resins than for zinc phosphate cements. The initial solubility may be of the same order but there will be no progressive disintegration of acrylic resin as is found in some instances with the inorganic cements. The only substances likely to cause breakdown of the acrylic resin are organic solvents which are rarely present in the mouth in sufficient concentration or for sufficient time to do any damage.

Mention should be made of another property, *adhesiveness*, which is not specified. This is omitted from the specification because the dental cements adhere only very weakly to tooth tissues and metals. They depend for their cementing ability on the fact that the walls of the cavity and inlay or crown are not perfectly smooth, and to dislodge the restoration by a direct pull it is necessary to shear the cement film. A high shearing strength, which is evidenced by a high compressive strength, is therefore necessary for a dental cement. Good adhesiveness would be of value, particularly in ensuring that the restoration does not pull away from the cement, or the cement from the cavity walls, with thermal expansions and contractions. Claims have been made for increased adhesive properties of some self-hardening resins when a special modifier is used. Tests clearly show that the force required to separate two flat pieces of glass or two flat surfaces of tooth hard tissue is definitely increased by the use of this modifier, provided the film between them is thin. There appears to be little evidence for increased adhesiveness of a mass of the resin to tooth substance. In other words there may be better adhesiveness with cemented appliances but not necessarily in the case of direct restorations.

Finally, some practical tests for evaluating the efficacy of dental cements may be mentioned. Fiasconaro and Sherman[1] have recently reported some work on the quantitative evaluation of the *cavity-sealing properties* of restorations by applying air pressure to suitably mounted restored teeth. A gold inlay sealed with ordinary cement required a pressure of 45 p.s.i. to produce a bubble at the margin of the restoration, whereas using a self-hardening resin the pressure required was only 20 p.s.i. These figures were reproducible if the restorations were carefully placed but otherwise considerably lower values were obtained. The cavity seal was adversely affected by radical thermal changes and this was most evident where acrylic resin was used either as a direct restoration or as a cementing medium.

REFERENCE.

1. Fiasconaro, J. and Sherman, H.—A quantitative method for evaluating the cavity-sealing properties of restorations: J.D.Res., 31:503 (Aug.) 1952.

*Current Notes (No. 18)**

Certified Dental Products.

There have been several enquiries as to why no products are yet listed as being certified to meet the three new Australian Dental Standards announced some time ago. This situation is quite justified in the case of modelling compound because technical difficulties have arisen in connection with its testing (see Current Notes No. 16), but there is no good reason why certification should not proceed with the other two products, namely, impression plaster and laboratory plaster.

Complaints about the quality of dental gypsum materials are common and it would be a useful guide to the profession to have listed the products that are considered to be satisfactory. If there are plasters, manufactured in Australia or imported, which would comply with the Dental Standards it would be in the interests of their manufacturer or distributor to see that they are included on the list of certified materials.

It is very unlikely that no such products are available at a reasonable cost, but if this is the case surely it is a reflection on a country which has a well-established industry producing plenty of high-quality gypsum materials for other purposes. The fact that the quantity of plaster required by the dental profession and dental laboratories is relatively small but the quality demanded is high naturally has economic implications which must be taken into consideration by a business enterprise, but any serious effort to produce a high-quality impression or laboratory plaster should receive every encouragement. The same applies to artificial stone for which a Standard is shortly to be issued.

Twenty certified products are now listed for the first three Australian Dental Standards relating to mercury, amalgam alloy and zinc phospate cement and it is pleasing to see that the quality of these products is being maintained. The Dental Materials Sectional Committee of the Standards Association of Aus-

*Contribution from the Commonwealth Bureau of Dental Standards in conjunction with the A.D.A. Standards Committee.

tralia recently decided to publish Standards for artificial stone and silicate cement and to issue drafts for public critical review for inlay wax, inlay casting golds and denture casting golds. The latter three drafts should be available to the members of the profession for comment at an early date. This makes eleven Australian Dental Standards completed or almost so.

It is of interest to note that, through the British Standards Institution, committees have been set up to consider the preparation of British Standards for dental materials. Already committees have met to consider specific groups of dental goods such as acrylic resin materials, tools and laboratory apparatus, and conservation materials.

Correspondence

"Local Anaesthesia"

Sir,

There have lately been quite a number of complaints of the lack of anaesthesia sufficiently profound for pulp extirpation, following on mandibular block injection, even when anaesthesia is present in the lip to the mid-line.

It will be found that a supplementary injection with an ordinary $\frac{7}{8}$ in. needle syringe placed in the mucous membrane reflection overlying the mental foramen, at a point approximately midway between the 1st and 2nd bicuspid and at about root apex level, will greatly assist in obtaining sufficiently profound anaesthesia. This is preferable to supplementary pressure anaesthesia in the tooth cavity itself, which carries a risk of forcing infection into the hitherto uninfected portion of the pulp.

Yours faithfully,

LOTHIAN CRANE.

474 Military Road,
Mosman.

Editorials

Congress Commission Completes Plans for 13th Dental Congress

The 13th Australian Dental Congress will be held in Brisbane, June 1-5. All members have now received a copy of the Congress brochure which contains the application form for membership of Congress. Those who intend to enrol should do so immediately as this will ensure that the work of the Congress Commission in arranging both accommodation and other details of the organisation will be facilitated. Due to the problem of arranging sufficient accommodation, special emphasis must be directed to the warning given by the Commission that *applications must not be delayed*, if accommodation is to be reserved for all members.

The President, Professor S. F. Lumb, has given a convincing argument for not only the desirability of attending Congress, but the necessity of being in Brisbane in the first week of June, 1953, to appreciate all the northern capital can offer by way of its renowned hospitality and perfect climate.

Professor S. F. Lumb, President of the 13th Australian Dental Congress.

A well-balanced programme is assured and clinics, papers and films which will supply all the information on techniques, new advances and old problems will be of interest to the general practitioner and the specialist alike.

The social arrangements for Congress are most comprehensive and will ensure that

everyone attending will have a memorable week from June 1 to 5.

Members of Congress and their families will be coming to a city famous for its splendid

The Cloisters, University of Queensland, St. Lucia, Brisbane.

winter climate, and to a state which has unlimited natural resources and will provide an education for all.

Blood is Essential

In this issue of the Journal there appears a brief summary of some of the activities of the Red Cross.

The service that this organisation provides in which we as dentists should be particularly interested is the blood transfusion service.

As a result of our professional training we together with the medical profession can play an important role in assisting the Red Cross appeal for blood donors. In both patient, social and communal contacts interest can be stimulated in this vital service. In peace and in war, from the maternity ward to the battle line, the need for blood is ever present.

Countless lives depend upon the continued donation of blood, for blood and blood plasma have no substitute.

In a recent appeal the American Dental Association urged members to co-operate in the community blood blank programme.[1] The concluding sentence we could well bear in mind:

"Offer your services and offer your blood!"

1. They need your blood (ed.) J.A.D.A. 45:713-4 (Dec.) 1952.

News and Notes

13th Congress Secures Overseas Lecturers

Dr. Earl Pound, Prosthodontist, of Los Angeles, has accepted the invitation from the Congress Commission to lecture at the 13th Australian Dental Congress. Dr. Pound, who is a member of the American Denture Society, is a leading Prosthodontist in the United States and is an expert on phonetics. At the recent Annual Meeting of the American Dental Association in St. Louis, he took part in two clinics, "Controlling Lip and Facial Contours with Artificial Dentures" and "Tinting of Dentures."

It is hoped that Dr. Pound will give three separate illustrated lectures, and by using the large lecture theatre which will accommodate approximately 400 people, all members will have an opportunity of attending. Further details will be given in the next issue of the Journal.

The Commission has also been fortunate in securing for Congress Dr. Roy P. Rheuben, who practises in Reno, Nevada. Dr. Rheuben is a native of Queensland and practised for some years in Brisbane before taking up permanent residence in the United States. He will present an illustrated lecture on "The Hydrocolloid Technique for Full Mouth Reconstruction."

Dr. Ray Gill, of California, will be sending out a paper and supporting film on Crown and Bridgework.

Although no definite information has been received from the American Dental Association regarding a representative, the secretary, Dr. Harold Hillenbrand, has been most co-operative with offers of films, papers and hopes to be able to get at least one of their members to attend Congress.

Members attending Congress are assured of some fine lectures during the week.

Members are reminded that accommodation is always a problem at Congress and therefore early receipt of their application forms will help the accommodation committee considerably.

The Battle for Sound Teeth

The effects of adding fluorine to community water supplies on the dental status of the population have been the subject of study for some time. It has been determined that too high a concentration of fluorine produces mottling of the enamel; and that a complete lack is conducive to excessive caries formation. It has been conclusively demonstrated that an optimum fluoride content, of the order of one part per million, will reduce caries in children to about one-half its normal incidence, while failing to produce mottling. The optimum amount is as effective whether water supplies have been blended to reduce the natural fluoride content to the desired level or fluorides have been artificially added to bring the content up to the established concentration. No harmful effects whatever have been observed from drinking waters containing the recommended amount of fluoride, either in those who have been exposed to it naturally for as long as 80 years, or in those who have received it on a planned basis for over five years.

An impressive number of professional health organizations have reviewed the literature—independently, it must be added—and have concluded that artificial fluoridation of public water supplies in controlled amounts is desirable as one effective means for the partial control of dental caries in the young. In view of its far-reaching effect on a staggeringly massive problem, and in the absence of demonstrable ill-effects, fluoridation of water supplies must be reckoned with as one of the most significant tools of preventive medicine which has been devised in recent years.

Debate between the conservative and the progressive elements is traditional in our society and is desirable to maintain good balance; but the instinctive tendency of certain minds to fear any departure from the supposedly beneficent processes of nature cannot be indefinitely condoned, in the face of accumulating mountains of evidence. Furthermore, it is unfortunate that the case of the conservative should be intensified—as in this instance—by the support of vested interests and of fanatics and members of the lunatic fringe who appear to consider dental caries as an essential part of the "American Way of Life" and any attempt to alter its incidence as Communist-inspired mass-poisoning.

A particularly striking example of the unfortunate effects of such opposition was described at the Denver meeting of the Western Branch of the APHA last June.

The movement for fluoridation in Seattle, Wash., began with a revealing study by the PTA in 1950, which disclosed that the average child in the eleventh and twelfth grades had nearly 15 decayed, missing or filled teeth. The director of the Seattle-King County Department of Public Health, after thorough consideration of the evidence, and with the approval of the local medical and dental societies, recommended to the City Council in February, 1951, the introduction of fluoridation. At first there was no opposition except from some representatives of the Water Department. The Water Department produced a fantastically high estimate of cost ($1.20 per year for each of the premises served); and, a local election being in sight, the City Council dodged its responsibilities by submitting the desirability of fluoridation (at this assumed cost) to the people in a referendum in March.

The Department of Public Health, with the approval of the medical and dental societies, secured the appointment of a highly representative Committee for Fluoridation with a Speaker's Bureau (on which 37 dentists served). At the beginning of the campaign, however, persons vocal in opposing fluoridation formed the Washington State Council Against Fluoridation which was backed by the National Nutrition League, Inc. Most of these were owners, operators, and patrons of so-called "health food" stores. Later, about the first of February, Christian Scientists, deploring "compulsory medication," took the lead in forming the Anti-fluoridation Committee. An attorney served as chairman, a trained publicity man worked with him, and a Speaker's Bureau was formed. Billboards opposing fluoridation appeared during the last week or so of the campaign.

Following the formation of the Anti-fluoridation Committee in February, opposition speakers appeared on a wide variety of programmes. Added to the ranks of the opposition were three physicians from the Medical Society, and several well-known attorneys who appeared at meetings, on the radio, and on television, to debate the issue on the basis of invasion of individual rights. and alleged pressure for the programme from Oscar Ewing and the U.S. Public Health Service. Their suggested alternative was to add fluorides to salt.

Although a great deal of nonsense has been talked about the subject, perhaps the climax of absurdity was reached in this debate by the claim that the addition of fluoride was "Socialized Medicine."

Radio and television stations became active instruments for local propaganda. The Committee for Fluoridation issued 10,000 copies of a pamphlet and the opposition distributed great quantities of literature. The first of these pamphlets carried a skull and crossbones on the front. Reprints were distributed including accusations of "Socialized Medicine" and recommendations for a "campaign for better systemic health through natural nutritious foods." Fluorine was described as "rat poison" which would cause hardening of the arteries, would interfere with kidney excretion, cause bones to become brittle, and might cause cancer. It was alleged that fluorine was used in Germany after World War I to "weaken the wills of the people."

The battle continued for nine weeks; and on 11th March the fluoridation proposal was defeated by a vote of two to one.

The reader will be inclined to say that such a campaign could not take place—and certainly could not succeed—in an educated American community. But it did and the teeth of Seattle children must continue to ache.

In reading about this case, one is forcibly reminded of the outcry which occurred in Boston in 1721 against smallpox inoculation. Cotton Mather, the learned divine who played a courageous part in defending the practice, says he "never saw the Devil so let loose . . . A lying spirit was gone forth at such a rate that there was no believing anything one heard . . . The people who made the loudest cry . . . had a very Satanic Fury activating them. They were, like the possessed people in the Gospel, exceeding fierce."

Perhaps even more menacing, in view of its national import, is the recent display of the same prejudiced thinking in the setting of that recurrent phenomenon, a Congressional investigating committee. The House Select Committee To Investigate the Use of Chemicals in Foods and Cosmetics, more easily known as the Delaney Committee, has just published over 600 pages of its hearings on fluoridation of water supplies. The saddest part of the hearings reports the mental gymnastics of a physician member of the Committee, formerly a public health official, who proclaimed for the record that public health officials force state health officials to carry out programmes presumably against their will by means of bribery; and, finally, that "you can prove most anything you want to by the statistical figures on morbidity and mortality." This gentleman may—or may not—have revealed his own personal motivations in these statements. He certainly did not represent the public health profession, with which he was for a short time allied.

The opposition to fluoridation is not easy to understand. Perhaps only the psychiatrist can find an adequate explanation for the phenomenon, since an exaggerated fear of change is a common symptom of insecurity. The primary interests involved are those of the dentist; and with a vision and a public spirit worthy of the highest praise, they are precisely the people who have led in this campaign. All honor to them!

The Friends of Dental Caries won in Seattle and showed strength in the House Committee to which we have referred. They won the battle of Seattle; but they cannot win the war. "Truth is Mighty" and, in the long run, it will prevail.

1. Lehman, S. P., and Kahn, B. L.—"Seattle Votes on Fluoridation." Seattle, Wash. Seattle-King County Department of Public Health, 1500 Public Safety Building.
(Reprinted from the American Journal of Public Health, October, 1952, pp. 1304-1306.)

University of Pennsylvania

Dr. Lester W. Burket, Dean of the School of Dentistry, University of Pennsylvania, has announced the appointment of Dr. LeRoy M. Ennis as Chairman of the 75th Anniversary Celebration Committee.

The Dental School, founded 6th March, 1878, was the third university dental school in America. The first class to be graduated was 1st March, 1879, and since that date, 7,922 graduates have entered into the practice of dentistry in every state of the Union and in nearly every foreign land.

Dr. Ennis, Professor of Roentgenology, and past-president of the American Dental Association, has named a committee of 12 men to assist him in arranging plans for the celebration, which will take place on 10th, 11th, and 12th June, 1953. An extensive programme has been planned by the committee and the largest assembly of Alumni in the school's history is expected. The committee is very desirous of receiving messages from Alumni in foreign lands for this occasion. These messages will be placed in the historical record.

Red Cross Serves All

Hundreds of thousands of people throughout Australia have been helped through Red Cross services, in war and in peace.

The major service which Red Cross offers the community is blood transfusion. Whole blood and serum are provided free by the Red Cross to everyone in Australia requiring transfusions. Last year 121,826 donors were bled and 51,689 pints of whole blood and 17,721 pints of serum were used by the community. Mobile Blood Units in almost every

State travel around the country enrolling blood donors. This service accounts for almost one-fifth of the total Red Cross expenditure.

Another major service to the community is the maintenance of T.B. Homes and Hospitals. In New South Wales, there are three modern hospitals, including one specially fitted for dealing with tubercular mothers. One of these hospitals, Bodington, is equipped to give the most advanced surgical treatment to patients. Costs of the T.B. Hospitals account for 13 per cent. of the total Red Cross budget.

While it is possible to dissect the Red Cross budget, it is not possible to put a price on many of its services. These services in Australia make up the Red Cross contribution to the health and happiness of the nation. They are planned to fill a need which is not otherwise met by a government organisation or similar body. Because of the tremendous and self-sacrificing voluntary work of Red Cross members, costs are kept at a minimum, but, even so, more than a million pounds are spent yearly on these services.

That is why Red Cross appeals to the public every year for support—for the hundreds of thousands of Australians who depend on these services, the people who are saved through blood, the tubercular mothers, the servicemen in the field—these are the people you help when you help Red Cross!

Help now with your services, or your money!

World Conference on Endodontics

The schedule for the World Conference on Endodontics to be held at the School of Dentistry, University of Pennsylvania, 21st to 27th June, 1953, has now been completed. The programme will include outstanding men in their respective fields from various parts of the world. Among the leading Endodontists who will participate in the Conference are Dr. B. Nygaard Ostby of Norway, Dr. W. Stewart Ross of England, Dr. Francisco Pucci of Uruguay, Dr. George Hare of Canada, and others. In addition, a number of prominent physicians such as Dr. John A. Kolmer, Dr. Frank Melemey and Dr. W. Paul Havens, will take part in the programme.

Tuition fee for the conference $100. Applications will be accepted in the order received. Apply to Postgraduate Courses, School of Dentistry, University of Pennsylvania, 4001 Spruce Street, Philadelphia.

Regulations Relating to the Examinations for the Diploma of Fellow in Dental Surgery (F.D.S.R.C.S., Eng.)

GENERAL REGULATIONS.

1. The Diploma of Fellow in Dental Surgery of the Royal College of Surgeons of England may be granted to those who possess a dental qualification registrable in the British Dentists' Register and to graduates or diplomates in Dental Surgery of those Universities and other Licensing Bodies recognised by the Council for the purpose, who comply with the regulations hereinafter set forth.

2. Candidates for the diploma are required to pass two examinations, namely, the Primary Examination and the Final Examination, after obtaining a recognised qualification in dental surgery.

3. The fees payable for admission to the Primary and Final Examinations are set out in regulations 19 and 24.

4. The fees payable before the diploma can be granted, in addition to the fees payable for admission to the examinations, are:—In the case of Licentiates in Dental Surgery of the College, £10/10/-. In the case of all other candidates, £21. These fees are not payable until both examinations have been passed.

5. The Diploma of Fellow in Dental Surgery cannot be granted to a candidate who has not attained twenty-five years of age. A candidate may, however, enter for the Final Examination before he has reached this age.

6. The Diploma of Fellow in Dental Surgery of the Royal College of Surgeons of England is registrable in the British Dentists' Register as an additional qualification, provided that the name of the holder already appears in that Register. Full particulars regarding the registration of the diploma can be obtained from the Registrar of the Dental Board of the United Kingdom, 44 Hallam Street, London, W.1.

7. All enquiries and communications with reference to the examinations for the Diploma of Fellow in Dental Surgery must be addressed to the Examinations Secretary, Examination Hall, Queen Square, London, W.C.1.

8. Applications for admission to the Primary examination must reach the Examinations Secretary at least twenty-one days before the examination begins, and for the Final examination at least thirty-five days before the examination begins.

9. The dates of the examinations are published annually in the Examinations Calendar, obtainable free of charge from the Examinations Secretary.

10. Applications for admission to either examination must be accompanied by the required certificates and the full amount of the fee payable for the examination. Candidates may enter for both the Primary and Final Examinations *at the same time*, on the understanding that should they be unsuccessful in the Primary Examination, their entry for the Final Examination will be withdrawn and the fee payable for that examination will be refunded in full.

11. A candidate withdrawing an application for admission to an examination, in writing, may receive back the full amount of the fee paid, provided that such withdrawal is received before the date on which the applications are due as shown in the Examinations Calendar.

A candidate withdrawing an application for admission to an examination on or after the date on which applications are due—as shown in the Examinations Calendar—or who fails to appear for an examination for which his entry has been accepted, may receive back one-half of the full amount of the fee paid. The proportion of the fee to be returned may be varied at the discretion of the Council on the production, *within seven days* of the withdrawal or failure to appear at the examination, of medical or other evidence of compassionate grounds satisfactory to the Council.

(*Applications for the exercise of the Council's discretion under the foregoing paragraph must in all cases be addressed to the Examinations Secretary.*)

12. Candidates who desire to make representations with regard to the conduct of their examinations must address them to the Examinations Secretary and not in any circumstances to an Examiner.

13. The Council may refuse to admit to examination or to proceed with the examination of any candidate who infringes any of the regulations or who is considered by the Examiners to be guilty of behaviour prejudicial to the proper management and conduct of the examination.

14. Papers set at the several examinations are published annually, and may be obtained from Messrs. Taylor & Francis, Ltd., Red Lion Court, Fleet Street, London, E.C.4, at the price of 1s. 2d. (including postage) for each year's papers.

Primary Examination.

15. The examination is held in the months of April and October, unless otherwise ordered.

16. The subjects of the examination are (a) Applied Anatomy, including the anatomy and histology of the teeth and jaws, and (b) Applied Physiology and the Principles of Pathology of importance in Dental Surgery.

17. The examination is partly written and partly oral.

18. Candidates are admissible to the examination (*vide* paragraph 10) at any time after obtaining one of the qualifications specified in paragraph 1.

(*Candidates whose names do not appear in the current Dentists Register must submit evidence of their qualification, and of the date of acquirement thereof.*)

19. The fee payable for admission or re-admission to the examination is £8 8s. 0d.

Final Examination.

20. The examination is held in the months of July and December, unless otherwise ordered.

21. The subjects of the examination are (a) Surgery, (b) Oral Pathology and Bacteriology, and (c) Dental Surgery.

22. The examination in Surgery is partly oral and partly clinical. The examination in Oral Pathology and Bacteriology and Dental Surgery is partly written, partly oral and partly clinical, and includes the examination of patients and operative dental surgery.

(*Candidates should bring with them white coats and hand instruments necessary for conservative dental surgery, and any hand instruments for minor oral surgery which they may desire.*)

23. Candidates who have passed the Primary Examination are admissible to the examination on production of evidence of:

(a) Having been engaged in the acquirement of professional knowledge for not less than two years subsequent to the date of having obtained a qualification specified in paragraph 1.

(b) Having held for not less than six months a whole-time hospital appointment or appointments approved by the Council for the purpose. Candidates who have not exactly fulfilled the requirements of this regulation may submit their record of experience to the Examinations Secretary, to be assessed by the President.

24. The fee payable for admission or re-admission to the examination is £15 15s. 0d.

25. The list of Universities and Colleges whose dental degrees and diplomas are recognised by the Council.

Scope of the Examinations.

The following information is for the guidance of candidates and indicates only the general scope of the examinations. No detailed syllabus is issued.

Primary Examination.

Anatomy.

The developmental and topographical anatomy of the head and neck, with special

reference to application to dental practice. The topographical anatomy of the thorax and abdomen sufficient for the understanding of physiological processes and disease.

The evolution, development, macroscopic and microscopic structure of the dental tissues. Comparative anatomy illustrative of the evolution of the dentition and adaptation to function.

In the following subjects, attention will be directed to principles, especially to those which have application in the field of dental surgery. A detailed knowledge of experimental and histological technique will not be required.

Physiology.

The principles of human physiology, with special reference to development, calcification, growth, metabolism and nutrition. Function, growth and retrogressive changes in the teeth and jaws. Influence of heredity, endocrine system, diet and metabolism on the teeth and jaws. Salivary glands and saliva. Mastication, deglutition, taste, phonation and articulation.

Pathology.

The principles of pathology and bacteriology, including inflammation, fever, immunity, infection, repair, disturbances in metabolism, growth and body fluids, local and somatic death, diseases due to bacterial infection, viruses and neoplasia.

Final Examination.

Surgery.

Surgical principles and practice. Systemic disease with oral manifestations. The regional surgery of the face, lips, tongue, salivary glands, skull and jaws.

Dental Surgery and Pathology.

Candidates may be examined in any branch of dental surgery and pathology, including operative dental surgery, dental materia medica, and in bacteriology and radiology in relation to dental surgery.

FACULTY OF DENTAL SURGERY.

Postgraduate Education.

Postgraduate Lectures in General, Oral and Dental Surgery are held twice yearly at the College.

In addition the Departments of Anatomy, Physiology and Pathology are available for instruction in the Basic Sciences in their application to Dental Surgery.

Residential accommodation in the College is available for students attending courses.

The Library and Museum are open daily.

Full details may be obtained on application to Mr. W. F. DAVIS, Secretary, Faculty of Dental Surgery, at the College, Lincoln's Inn Fields, London, W.C.2.

Western Suburbs Dental Ball

The Western Suburbs Dental Group wish to announce that their Annual Ball will be held at the Petersham Town Hall on Tuesday, 13th June, 1953.

Tickets may be obtained and reservations made through Mr. H. C. Osborne, Bank of N.S.W. Chambers, Church Street, Parramatta.

Jennings Shield

The 17th Annual Cricket Match between the Dentists and the Dental Undergraduates for the Jennings Shield took place on 12th November on the picturesque University Oval in the presence of many prominent members of the profession.

The Undergraduates registered a fine victory.

The Dentists, winning the toss, sent the Undergraduates in on a soft wicket, and these immediately went for runs and hit up 108 for the loss of 4 wickets. They then closed the innings and dismissed the Dentists just at stumps drawn for 92 with a win of 16 runs.

Dr. Allan Lawes proposed the toast of the teams, which was responded to by Ken Binns, Captain of the Dentists' team and John Latimer, Captain for the Undergraduates.

The winning trophies were presented by Dr. John Brookes to Undergraduates D. Hutchinson (Batting), W. Calov (Bowling), and E. Kelly (Fielding), and to Dentists R. Thompson (Batting), R. Stewart (Bowling) and E. Morris (Fielding).

A vote of thanks to the donors proposed by John E. Spencer was responded to by John T. Jennings, Snr.

Association Activities

Australian Dental Association (Federal Office)

FEDERAL NEWSLETTER No. 8.

The Annual Meeting of the Federal Council of the Australian Dental Association was held in Sydney throughout the day of Saturday, 18th October, 1952, all State Branches being represented at the meeting. The Federal Executive met on the previous day.

Election of Officers 1952-53.

The only nominations received being those of the retiring officers, the chairman declared these officers re-elected in accordance with the Constitution. The Federal Officers of the Association for the ensuing two years are:

President: Dr. J. V. Hall Best.
Vice-President: Dr. K. T. Adamson.
Interstate Vice-President: Dr. J. M. Wark.
Hon. Secretary: Mr. N. E. Edney.
Hon. Treasurer: Dr. A. G. Rowell.

The appointment by the Federal Executive of Mr. E. F. Hewlett as Executive Secretary until the next Annual Meeting of the Association was confirmed by the Annual Meeting of the Federal Council.

At the direction of the President the office of the Association will be situated in Sydney.

The Annual Meeting of the Council considered the Annual Report, the Balance Sheet and Treasurer's Report, Reports of Committees, Special Reports of the Federal Officers and other matters of general business.

The following current matters of general interest arise from the business transacted at the meeting:

Pharmaceutical Benefits.

The Federal Office has completed submissions to the Minister for Health, the Rt. Hon. Sir Earle Page, on the proposed list of drugs and the functions of dentists under the proposed amendment of the Act.

Recommendations regarding the establishment of supervisory committees were also submitted.

These submissions and recommendations were approved by the Federal Council.

Repatriation Dental Service.

The Vice-President (Dr. K. T. Adamson) and Interstate Vice-President (Dr. J. M. Wark), who have given much time and energy to the protracted negotiations with the Repatriation Commission in relation to Repatriation Dental Benefits, presented a full and comprehensive resume of these negotiations.

Favourable results have been obtained in the negotiations as to the administration of the Repatriation Dental Benefits Scheme, but finality has yet to be reached on the Schedule of Treatment and Fees submitted by the Association and being considered by the Federal Treasury.

Some of the items approved by the Treasury are considered satisfactory, but further negotiations are being carried out as to certain items considered unsatisfactory. It is hoped that these negotiations will soon be completed and that the approval of the Treasury will enable finality to be reached with the Repatriation Commission on the Scheme on a basis satisfactory to members.

Federation Dentaire Internationale.

It was resolved by the Federal Council that the Australian Dental Association continue its membership of the Federation Dentaire Internationale under the new Articles of Association and Regulations adopted in London in July, 1952, as a "corresponding member." This form of membership permits the attendance of an "Observer" to any meeting of the Federation, but not a "Delegate." It was felt that the budgetary limitations and the geographical isolation of the Australian Dental Association prevented the subscription necessary for full membership but the Council appreciated the necessity for some form of affiliation by this Association with this international organisation.

Fluoridation of Drinking Waters.

The decision of the National Health and Medical Research Council in relation to the fluoridation of public water supplies (quoted in Newsletter No. 7) was endorsed by the Federal Council and should act as a useful guide to State Branches when approaching State Governments contemplating the practical application of this caries-reducing measure.

13th Australian Dental Congress.

The Queensland Branch reported that the arrangements for the 13th Australian Dental Congress to be held in Brisbane from 1st-5th June, 1953, were progressing most favourably.

Basic Plan for Dental Congresses.

The Basic Plan for the Organisation of Dental Congresses which had been most carefully drafted by Dr. R. G. Williams and circulated to State Branches was considered and approved subject to certain amendments. The adoption of this Basic Plan will greatly facilitate the work of State Branches organising these periodic functions in the future.

Appointment of Representatives.

The Federal Council expressed its appreciation of the duties of various Committees and of the representatives appointed by this Association to various organisations.

The existing Standards Committee was reappointed and Mr. Edward Campbell was added to the Committee as an additional member. The Federal Council expressed its appreciation of the work carried out by this Committee during the year.

The following appointments were made by the Annual Meeting:

Professor A. J. Arnott was appointed representative of the Association on the National Health and Medical Research Council for the ensuing two years.

Mr. Hartley Gibson was appointed to represent the Association on the Flying Doctor Service.

Calculation of Provisional Tax.

It is desired to draw the attention of members to the fact that upon receipt of their Income Tax Assessment on the financial year ending 30th June, 1952, which will include Provisional Tax payable in respect of their income for the year ending 30th June, 1953, or by 31st March, 1953, whichever is the later, it is incumbent upon every taxpayer to make a calculation of his income for the year ending 30th June, 1953, and to assess the Provisional Tax payable thereon.

Alternatively, he may, if he so desires, accept the Provisional Tax and estimated income as assessed by the Taxation Department.

In the event of the taxpayer's income varying by more than 20% from his own estimation or from the estimation made by the Taxation Department, upon which they have based the Provisional Tax in the Assessment if he elects to accept this estimation, the Commissioner is empowered to impose a penalty.

J. V. Hall Best,
Federal President,
23rd January, 1953.

Australian Dental Association (New South Wales Branch)

Annual General Meeting.

Annual Report, Treasurer's Report, Appointment of Auditor.

The Annual General Meeting of the Association was held on 25th November, 1952, on which occasion the Annual Report, Treasurer's Report and Balance Sheet as circulated to all members of the Association were adopted.

The meeting further appointed Messrs. C. O. Beck and Wayland, Auditors of the Association.

Honorary Members for 1953.

The meeting elected the following persons Honorary Members of the Australian Dental Association, New South Wales Branch, for the year 1953:

The President, Australian Dental Association; The President, British Dental Association; The President, American Dental Association; The President, New Zealand Dental Association; The President, British Medical Association (N.S.W. Branch); The President, Dental Board of New South Wales; Professor A. J. Arnott, Professor Harvey Sutton, Dr. P. C. Charlton, Dr. N. E. Goldsworthy, Mrs. John Barr, Mr. T. T. Alkin.

Election of Executive.

The results of the ballot for the election of the Executive for the ensuing year were announced to the meeting.

At the conclusion of the Annual General Meeting the new Executive retired to elect Officers and Statutory Committees.

An Ordinary Meeting of the Association continued during which a film programme was presented and, upon the return of the Executive to the meeting, the office-bearers for the ensuing year were announced.

Extraordinary General Meeting.

An Extraordinary General Meeting of the Association was held prior to the Annual General Meeting on 25th November, 1952.

The business of the meeting was to deal with certain proposed alterations to the Articles of Association and By-laws of the Association. The Special and Extraordinary Resolutions relating to these changes were carried by the meeting without dissent.

Executive Report.

Additional Members of the Executive.

The following members have been appointed Additional Members of the Executive for the current year upon the nominations of the various Divisions of the Association:

J. H. Anker (Blue Mountains Division); H. W. Shand (Far North Division); G. R.

Solomon (Newcastle and Hunter River District Division); Dr. B. T. Martin (North and North West Division); F. C. Hadden (North-Eastern Division); Dr. J. D. Oddy (South Coast Division); A. Broughton (Southern Division); M. Hamilton (Southern Tablelands Division); L. B. Hume (Western Division).

Committees:

The following Committees have been appointed by the Executive:

Defence: Dr. E. R. Magnus, Chairman; Dr. F. E. Helmore, Mr. N. E. Edney, Mr. C. C. Croker, Mr. J. G. Fletcher.

Journal: Mr. A. G. Hunter, Chairman; Mr. G. Baulman, Mr. E. J. Gee, Mr. N. D. Martin, Mr. R. Y. Norton, Mr. R. Tompson, Dr. Ellice Weir.

Dental Health: Mr. N. D. Martin, Chairman; Dr. O. Basil-Jones, Dr. R. McMullin, Mr. B. W. Maundrell, Mr. J. Noble, Mr. R. Y. Norton, Mr. T. Royse-Smith, Mr. J. W. Skinner, Mr. R. Tompson, Mr. G. Morse Withycombe.

Committee of the Honorary Officers: Mr. N. E. Edney, Chairman; Dr. F. E. Helmore, Dr. A. G. Rowell, Mr. W. A. Grainger, Mr. R. Y. Norton.

Research: Mr. W. A. Grainger, Chairman; Professor A. J. Arnott, Dr. J. S. Baird, Dr. R. M. Kirkpatrick, Mr. N. D. Martin.

Ethics: Mr. H. McD. Finnie, Chairman; Mr. G. E. Baulman, Mr. J. G. Fletcher, Mr. E. J. Gee, Mr. R. Krauss, Mr. R. G. Leeder.

Syllabus: Mr. W. A. Grainger, Chairman; Mr. E. J. Gee, Mr. N. D. Martin, Dr. A. G. Rowell.

Divisions: Mr. R. Krauss, Chairman; Mr. J. H. Anker, Mr. A. Broughton, Mr. M. G. Hamilton, Mr. L. B. Hume, Dr. J. D. Oddy.

Sports and Social: Mr. R. Y. Norton, Chairman; Mr. K. O. Binns, Mr. J. G. Fletcher, Mr. R. G. Leeder, Mr. L. J. Noone, Mr. F. R. Reid, Mr. T. Royse-Smith, Mr. R. W. Wilson.

Benevolent and Provident Fund: Mr. W. A. Grainger, Chairman; Mr. R. C. Dennett, Mr. R. Krauss, Mr. L. J. Noone, Dr. J. D. Oddy, Mr. F. R. Reid.

Library: Mr. A. G. Hunter, Chairman; Dr. C. H. Graham, Dr. R. W. Halliday, Mr. N. D. Martin, Dr. W. D. Suthers, Mr. Ralph Tompson, Mr. A. O. Watson.

Post-Gradute Courses: Mr. W. A. Grainger, Chairman; Dr. G. V. Gengos, Dr. R. W. Halliday, Dr. F. E. Helmore, Mr. R. Krauss, Dr. R. N. McMullin, Mr. N. D. Martin.

Articles of Association: Dr. A. G. Rowell, Chairman; Mr. J. G. Fletcher, Mr. E. J. Gee, Mr. R. Krauss, Mr. R. Y. Norton, Mr. T. Royse-Smith.

Apprenticeship in Dental Technology: Mr. R. Krauss, Chairman; Mr. N. E. Edney, Dr. C. H. Graham.

Fluoridation of Drinking Water: Mr. N. D. Martin, Chairman; Mr. E. J. Gee, Mr. R. Krauss, Dr. A. G. H. Lawes.

Divisional Expenditure: Mr. J. G. Fletcher, Chairman; Mr. R. Krauss, Mr. R. Y. Norton.

Fact-finding Committee concerning direct contractual relationships with the public by dental technicians.

The Fact-finding Committee, set up by the Minister for Health to investigate proposals made to him that dental legislation be amended to permit dental technicians direct contractual relationships with the public in the supply of artificial dentures, has met on two occasions (24th November, 1952, and 2nd February, 1953).

The Association has taken steps to provide much detailed factual information for consideration by this Committee.

The meetings of the Fact-finding Committee will continue, so that a full report cannot be given at the present moment, but members will be advised of the full details as soon as possible.

Poisons Advisory Committee.

The Association has been granted representation on the Poisons Advisory Committee set up under the new Poisons Act, and the Executive has nominated Dr. E. R. Magnus as the Association's representative on this Committee, which appointment has been confirmed.

This Poisons Advisory Committee will have an important function in preparing the Schedules of Drugs to be listed under the Act and in advising as to the Regulations to be made.

Fluoridation of Drinking Waters.

The Association has appointed a special committee to advise the Executive as to the furtherance of the Association policy in regard to the fluoridation of drinking waters in this State.

The attention of a number of responsible public bodies has been drawn to this procedure.

The Executive wishes to encourage the formation of small local committees of mem-

bers within Divisions or smaller areas to implement the consideration by local authorities and the public of the fluoridation of water supplies for the partial control of dental caries.

The Committee is preparing a summary of latest data and opinions in this State for the use of such committees.

Articles of Association and By-laws.

Subsequent to the amendment of the Articles and By-laws of the Association at Extraordinary General Meetings in December, 1951, and November, 1952, the new Articles and By-laws are to be printed and all members will receive a copy in the near future.

Extension of the Boundaries of the Southern Tablelands Division of the Association.

The Executive at its meeting on 9th February, 1953, considered a request from the Southern Tablelands Division that the boundaries of that Division be extended to cover such towns as Camden, Picton and Campbelltown, these towns not being included in the boundaries of any country Division. The Executive resolved:

That the boundaries of the Southern Tablelands Division be extended to include those towns beyond a radius of 18 miles from the G.P.O., Sydney, not already included within the boundaries of the Western, South Coast, and Blue Mountains Divisions.

Technical film.

The Post-Graduate Courses Committee of the Association, with the active co-operation of several members and technical assistants, have completed the production of a film entitled "Precision Inlays by Hydrocolloid Technique."

This film, after final editing, will prove a most useful addition to the Association's film library.

Holiday Emergency Roster.

The holiday emergency roster arranged by the Association during the Christmas-New Year holiday period proved of great service to the public, over 500 calls being made for emergency dental treatment.

The Newcastle and Hunter River District Division also provided a holiday emergency service in the Newcastle area.

It is hoped to extend this service to other holiday periods and the co-operation of members will be sought to establish such service.

MEMBERSHIP.

Full members.

Bender, Peter Whitefield, B.D.S.; Brodie, Malcolm Sydney, B.D.S.; Calov, Robert, B.D.S.; Chappell, Brian Wilfred, B.D.S., L.D.S.R.C.S.; Coxon, Alfred Peter, B.D.S.; Ditchfield, Brian F., B.D.S.; Donaldson, William Robert Bruce, B.D.S.; Dunningham, Stephen John, B.D.S.; Edwards, Tainton Edward Albert, B.D.Sc.; Fryer, Frederic Herbert George, B.D.S.; Haddow, Peter G., B.D.Sc.; Harris, Robert, M.D.S.; Lewis, Harris Keith, B.D.S.; Lumley, Alan Max, B.D.S.; McKenzie, Donald James Gordon, B.D.S.; Marles, Frederick Geoffrey, B.D.S.; Moore, Thomas Marden, B.A., B.D.Sc., L.D.S.; O'Neill, Bernard Hugh, B.D.Sc.; Page, John Lawford, B.D.S.; Pearce, Graham Raymond, B.D.S.; Piper, Brian James, B.D.S.; Simpson, Colin Wallace; Smith, William Harrison, B.D.S.; Townsend, William Arthur.

Restricted members.

Cope, Norman; Hogue, Stephen James, L.D.S.; Ramsay, Edward Henry Pierson; Van Lubeck, Henry, D.D.S.

Qualified members.

Cusick, Alton Richard, B.D.S., D.D.S.; Graham, Campbell Harry, B.D.S., D.D.S.; Macansh, John Donald, B.D.S.; Parker, Rupert Bourke, B.D.S.; Pyke, Thomas Frederick, B.D.S.

Leave of absence.

Wood, P. B.

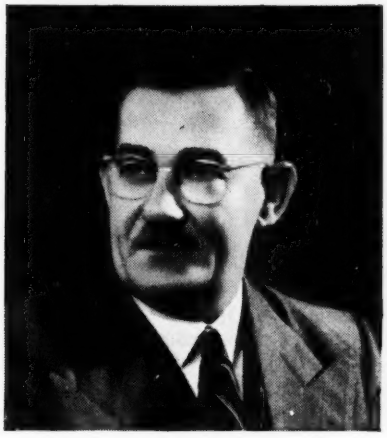
Resignations.

Barber, E. F. T., M.D.S.; Bardsley, R., B.D.S.; Barnes, Reginald; Benbow, H. J., B.D.S.; Blair, K. M.; Bourke, Kevin J., B.D.S.; Cooper, William P.; Dobinson, Ronald Joseph, B.D.S.; Douglass, A., B.D.S.; Dyball, R. J., B.D.S.; Hardie, H. G., L.D.S., B.D.S.; Heaphy, G. A.; Hicks, H., B.D.S.; Hughes, F. A.; Kerfoot, Geoffrey, B.D.S., D.D.S.; Lee, S. D., D.D.S.; Logan, C. D., B.D.S.; Lyons, C. A. A., B.D.S.; Matthews, C. B.; Moses, Cecil F.; Musgrave, Doreen, B.D.S.; Parry, Jack, B.D.S.; Spark, Allan E.; Stacy, G., B.D.S.; Wainwright, D. V. R.; Weaver, T. L., B.D.S.; Willington, A. D., B.D.S., D.D.S.

Student Associates.

Donald, John Gwynne Fraser; Mercieca, Frank; Mills, Gerald H.; Mills, Warren Malcolm; Newbrun, Ernest; Pringle, Jack A.; Roche, Maurice Bryan; Sebel, Abraham.

Australian Dental Association (New South Wales Branch)



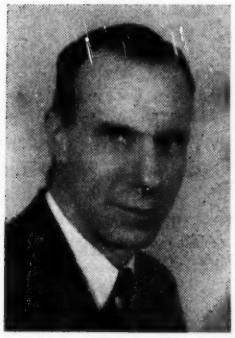
Mr. N. E. EDNEY
President

The following office-bearers were elected from the Executive for 1952-53:

President: Mr. N. E. Edney.

Vice-Presidents: Dr. F. E. Helmore, Dr. A. G. Rowell.

Honorary Treasurer: Mr. W. A. Grainger.



Dr. F. E. HELMORE
Vice-President

Dr. A. G. ROWELL
Vice-President

The Executive elected at the Annual Meeting for 1952-53 was:

Baulman, G. E.
Edney, N. E.
Fletcher, J. G.
Finnie, H. McD.
Gee, E. J.
Grainger, W. A.
Helmore, F. E.
Hunter, A. G.
Krauss, R.
Lawes, A. G. H.
Leeder, R. G.
Martin, N. D.
Norton, R. C. Y.
Rowell, A. G.
Royse-Smith, T.
Tompson, F. E. R.

Mr. W. A. GRAINGER
Honorary Treasurer

New Books and Publications

ORAL SURGERY, by Kurt H. Thoma, St. Louis, 1952, 2nd ed. C. V. Mosby Co. (1688 pp., 1789 illus.). Price £15/15/- (set of 2 vols.). *Our copy by courtesy of W. Ramsay (Surgical) Pty. Ltd.*

The second edition of this publication includes a separate chapter on chemotherapy and antibiotic therapy which will serve to be a valuable reference for the general practitioner as well as for the specialist.

The section on acquired jaw defects and surgical deformities covers the new developments in the treatment of these conditions.

The illustrations are well selected and the reproduction is excellent.

The second edition of this useful book offers a very handy manual of Oral Surgery.

—*A. J. Arnott.*

TOOTHBRUSHING AND MASSAGE IN PERIODONTAL DISEASE. (An experimental clinical histologic study), by Torsten Castenfelt, Stockholm, 1952; trans. by Stanley Vernon (115 pp., 36 illus.). *Our copy by courtesy of the author.*

This paper-covered treatise of 115 pages gives a detailed account of an experimental study of the effects of the toothbrush and wooden sticks (for interdental stimulation) on the gingivae.

This is probably the first serious attempt which has been made to investigate these effects in a properly controlled manner, and as such it must be regarded as a valuable contribution to periodontal literature. To quote the author's own words,

> Massage is a very old form of therapy in chronic periodontal disease and has been the object of very wide interest. Yet investigators hitherto have scarcely produced any facts on the basis of which it might be evaluated. The chief aim of the present investigation was to bring such facts to light.

Castenfelt's study appears to have demonstrated satisfactorily the ability of massage to reduce the depth of periodontal pockets, though this reduction averaged only .63 mm. after 33 days' massaging. The author describes this reduction in depth as experimentally significant, which it probably is; but from the therapeutic viewpoint it would be of value only in the very earliest cases of gingival pocket formation. In this regard, however, the real value of massaging lies in helping to *prevent* pockets from developing in the first place or, alternatively, from recurring once they have been eliminated.

The author was also able to demonstrate a significant reduction in the tendency to gingival bleeding as a result of massage (though he does not suggest to what changes in the tissues this improvement was due). One may comment here that clinical experience strongly supports this finding.

Most periodontists will be surprised to learn, however, that Castenfelt's investigations completely failed to demonstrate any increase either in the thickness of the horny layer of the gingival epithelium or in the *intensity* of keratinisation. Numerous references have been made in the literature to the keratinising effect of gingival massage, such authors as Gottlieb, Orban and Fish having referred to it as an accepted fact. Yet, when one comes to think of it, no experimental evidence of this presumed fact has ever been offered. Now it appears that there has never been any justification for such an assumption.

It certainly comes as a shock to learn (if the results of this investigation are as reliable as they appear) that gingival massage does *not* increase keratinisation of the gums, as so many of us had believed. There can be little doubt, however, that it does produce distinctly beneficial results which one must therefore attribute to (1) promotion of the vascular circulation, and (2) the improved standard of the oral hygiene which, through the nature of the methods employed, necessarily accompanies gingival stimulation or massage.

The author summarises the results of his experiment by stating:

> The results of this investigation support the view that massage is a valuable complement in the therapy of common chronic periodontal disease.

—*R. Tompson.*

Information from the Dental Board

The following matters are reported from meetings of the Dental Board of New South Wales held in November and December, 1952, and January, 1953.

APPLICATIONS FOR REGISTRATION.

Calnan, Edward Joseph, B.D.Sc., University of Melbourne, 1952.

Crowley, Joseph, B.D.Sc., University of Queensland, 1950.

Ditchfield, Brian Frederick, B.D.S., Unisity of Sydney, 1951.

Fryer, Frederick Herbert George, B.D.S., University of Sydney, 1951.

Weir, Keith Mervyn, B.D.S., University of Sydney, 1952.

RESTORATIONS TO REGISTER.

Aiken, A. H. J., McMaugh, L. S., Piper, B. J., Shanasy, T. L., Silienthal, B.

ADDITIONAL QUALIFICATIONS AND DESCRIPTIONS.

Cohen, M. J., D.D.S. (Northwestern); Cutler, R. H., D.D.S. (Northwestern); Donaldson, K. S., F.D.S.R.C.S. (England); Helsham, R. W., F.D.S.R.C.S. (England) (1952).

LOAN TO STUDENT.

An application for £125 as a dental loan for a student entering his third year was granted.

RETIREMENT OF DR. H. G. WALLACE.

Dr. H. G. Wallace received the congratulations of the Board upon his appointment as Director General of Public Health, and subsequent to such appointment notified his retirement from the Board. The Board expressed their appreciation of the assistance given by Dr. Wallace whilst he was a member.

Dental Health Education Department

DENTAL HEALTH LITERATURE.

Members are advised that supplies of the following literature are available at the office of the Association, and supplies ordered will be posted to members at the prices marked plus forwarding costs.

"Healthy Mouths"—Free of charge.

"Your Baby's Teeth and Your Own"—Free of charge.

"The Use and Care of Artificial Dentures"—3s. 3d. per dozen.

"Toothbrush Technique"—£1 per 100.

Samples of this literature will be forwarded on application.

Classified Advertisements

POSITIONS VACANT.

STATE PUBLIC SERVICE.
DENTAL OFFICERS OF SCHOOLS.
WESTERN AUSTRALIA

Applications for appointment as above on either a temporary or permanent basis are invited from Dental Surgeons.

Salary range: £1,197-£1,297 (gross) per annum on present basic wage.

Duties: To examine and give dental treatment to school children. Mobile surgeries and utilities are provided.

Location: Headquarters in country towns. Dentists required to work in towns and surrounding districts up to radius of 100 miles.

Applications stating age, qualifications and experience should be addressed, by 25th April, 1953, to The Secretary, Public Service Commissioner's Office, 60 Barrack Street, Perth, Western Australia. Further details concerning duties, conditions and allowances may be obtained by writing to that address.

GOVERNMENT OF TONGA.
DENTIST.

Applications are invited from qualified dentists for the post of Government Dentist, Nuku'alofa, Tonga.

Salary. £1000 per annum plus Cost of Living Allowance of 15% and temporary bonus of 12½% with right of private practice estimated to return £800 per annum.

Term of Appointment. Three years' resident service in first instance subject to probationary period of six months.

Partly furnished quarters are provided at rental of 10% of basic salary.

Passage money to and from the Kingdom at Government expense, and leave on basis of four days for each month of service.

Apply in first instance giving full details of age, marital status and professional qualifications to:—

Agents: Government of Tonga,
Box 543, G.P.O.,
Sydney, N.S.W.

POSITION WANTED.

Dentist, L.D.S.R.C.S. (Eng.), Guy's Hospital man, 25 years high class private practice in Johannesburg, South Africa, desires to emigrate to Australia and join similar large town practice. (Ex-service man).

Reply c/o., B. KORR,
7 Montgomery Street,
Kogarah, N.S.W.,
or Telephone LW 5820.

PRACTICES FOR SALE.

Dental practice, Southern Melbourne residential suburb. Owner going abroad. Cash takings £10,000 per annum. Excellent equipment. Beautiful home attached. Rent for house and surgery, £6/10/-. Home can be purchased. Practice price £6,000. Will accept £3,000 down, balance three years.

Dental practice, wealthy, progressive (primary and industrial). Tasmanian coastal town, two well-equipped modern surgeries. Beautiful house available if required. Nett profit average £1,750. Price £1,500.

Dental practices Victorian country and border towns, also Tasmania. Excellent opportunities for young experienced practitioners. Experienced assistants also required for country and Tasmanian practices, etc.
For further particulars of the above apply:—
Bosch Naylor Pty. Ltd.,
53A Russell Street,
Melbourne.

TO LET.

Rooms suitable for a dental practice. Situated on main street. Excellent position. Ring FX 2535.

GOOD OPENING FOR DENTIST.

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University of Sydney, Post-Graduate Committee in Dental Science

Members of the profession are notified that there are vacancies in courses of instruction to be held during 1953.

Any dentist desirous of attending a course or courses is asked to contact the Secretary, Post-Graduate Committee in Dental Science, Dental Hospital of Sydney, Chalmers Street, Sydney.

A. J. ARNOTT,
Chairman.

Course No. 31: *Full Denture Construction.*
24th August, 1953, to 28th August, 1953.
Enrolment limit—10.
Clinicians: Dr. C. H. Graham and Dr. A. G. Rowell.

This course will cover the clinical and laboratory procedures associated with recent advances in full denture construction. Lectures and clinical demonstrations will provide instruction on dental materials, impression techniques, methods of recording jaw relationships, arrangement of artificial teeth with emphasis on aesthetics and phonetics, a study of prosthetic malocclusion and edentulous anomalies with their appropriate treatment. Members of the course will be given an opportunity to carry out the clinical and laboratory procedures demonstrated.

Course No. 32: *Oral Surgery.*
31st August, 1953, to 4th September, 1953.
Enrolment limit—15.
Clinicians: Professor A. J. Arnott, Dr. H. R. Kemp, Mr. C. H. Ritchie, B.D.S.

The course will include a review of the fundamentals of surgery together with diagnosis and treatment planning clinics. Instruction will be given in regional anaesthesia and the surgical treatment of conditions which confront the general practitioner. The feature of the course will be the opportunity for members to obtain practical instruction.

Course No. 33: *Preventive Dentistry.*
10th August, 1953, to 14th August, 1953.
Enrolment limit—12.
Clinicians: Mr. N. D. Martin, M.D.S. and Dr. H. R. Sullivan.

All modern caries control techniques will be described and evaluated. Where necessary these techniques will be demonstrated. These will include: (i) Topical applications of fluorides, (ii) topical application with reference to impregnation techniques of zinc ferrocyanide and silver nitrate, (iii) dentifrices and mouthwashes: ammonium, penicillin, urea and fluoride and chlorophyll, (iv) use of low carbohydrate diets with actual diet plans for the treatment of rampant caries in patients of all ages, (v) refined and natural sugars and their effects on caries susceptibility, (vi) tests for caries susceptibility including lactobacillus estimations in saliva for use with low carbohydrate dietary control. Chemical susceptibility tests will also be demonstrated, (vii) the use of water fluoridation for partial control of caries will be studied as a public health measure. Fluorides as dietary supplements will also be discussed.
Here is an essentially practical application of all the findings of modern dental research and dealing specially with caries control measures which may be utilized in dental practice.

Course No. 34: *Orthodontics.*
Twelve months commencing 20th November, 1953, each Friday morning. Enrolment limit—8.
Clinicians: Dr. W. N. Benson, Mr. R. Y. Norton, M.D.S.

The course will include (i) series of lectures covering the field of Orthodontics, (ii) instruction in the technique of band formation, and appliance design, (iii) practical case analysis and diagnosis, (iv) treatment of selected cases of malocclusion, (v) observation of cases under treatment or cases of special interest that may present.

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Use in Dentistry

OXYCEL designates oxidized cellulose prepared from various materials, such as gauze or cotton by a special process of oxidation which converts unoxidized cellulose into polyanhydroglucuronic acid—an absorbable haemostatic chemical.

OXYCEL, supplied as individual, sterile strips, effects prompt haemostasis when applied to oozing surfaces, and when left in contact with incised tissues is readily absorbed. When wet with blood it becomes slightly sticky and swells, forming a dark-brown, gelatinous mass. As soon as this discolouration occurs, bleeding usually ceases.

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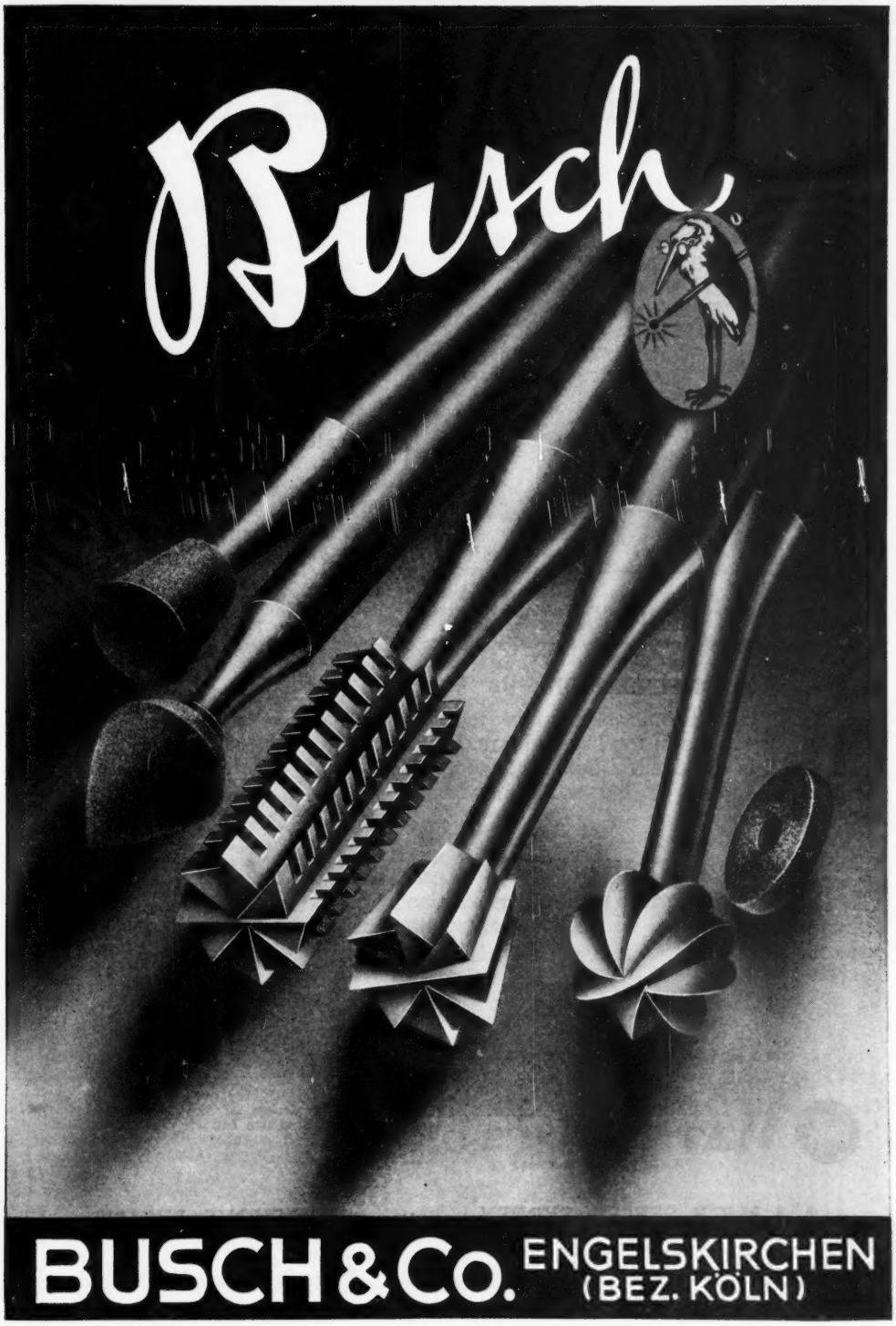

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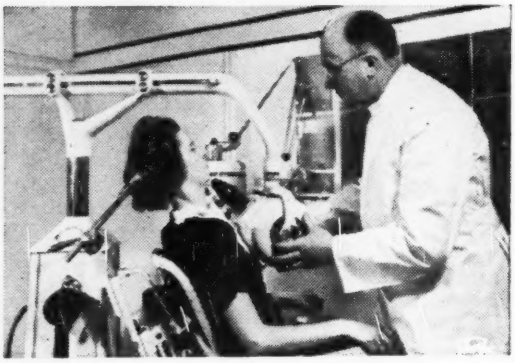

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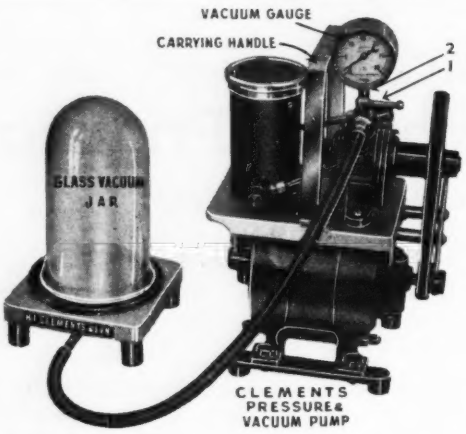

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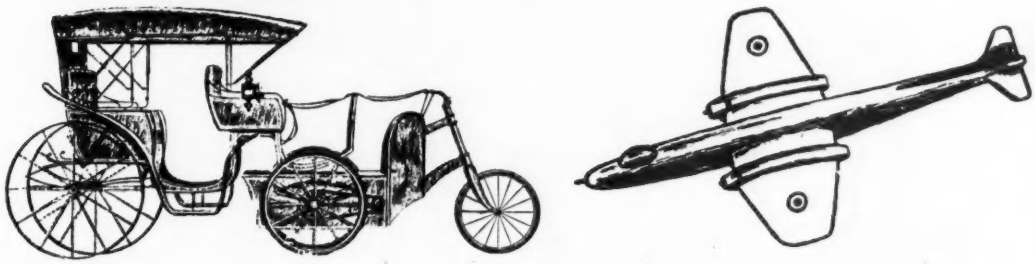

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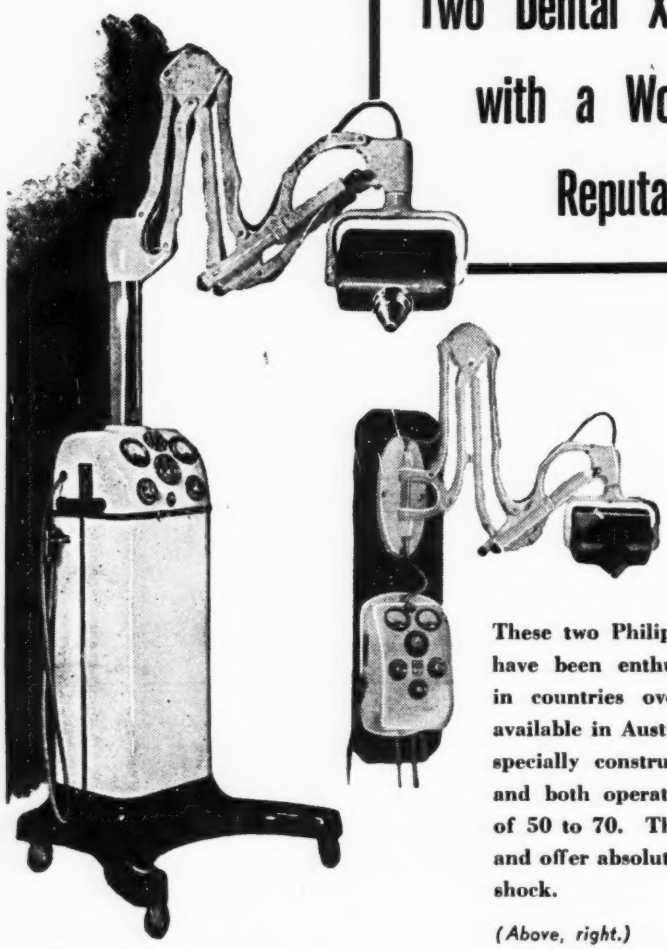
Two Dental X-Ray Units with a World-Wide Reputation



These two Philips Dental X-ray units have been enthusiastically acclaimed in countries overseas and are now available in Australia. Both units are specially constructed for heavy duty and both operate on a K.V.P. range of 50 to 70. They're easy to operate and offer absolute safety from electric shock.

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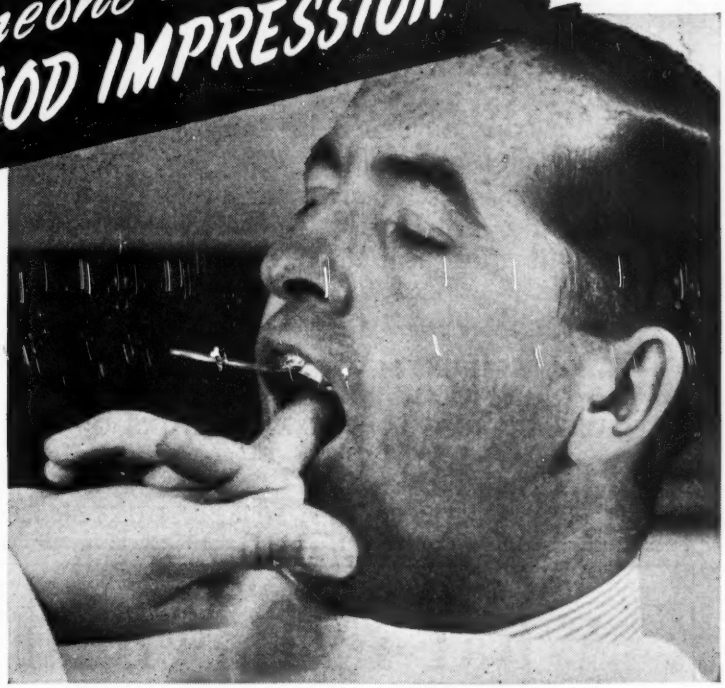

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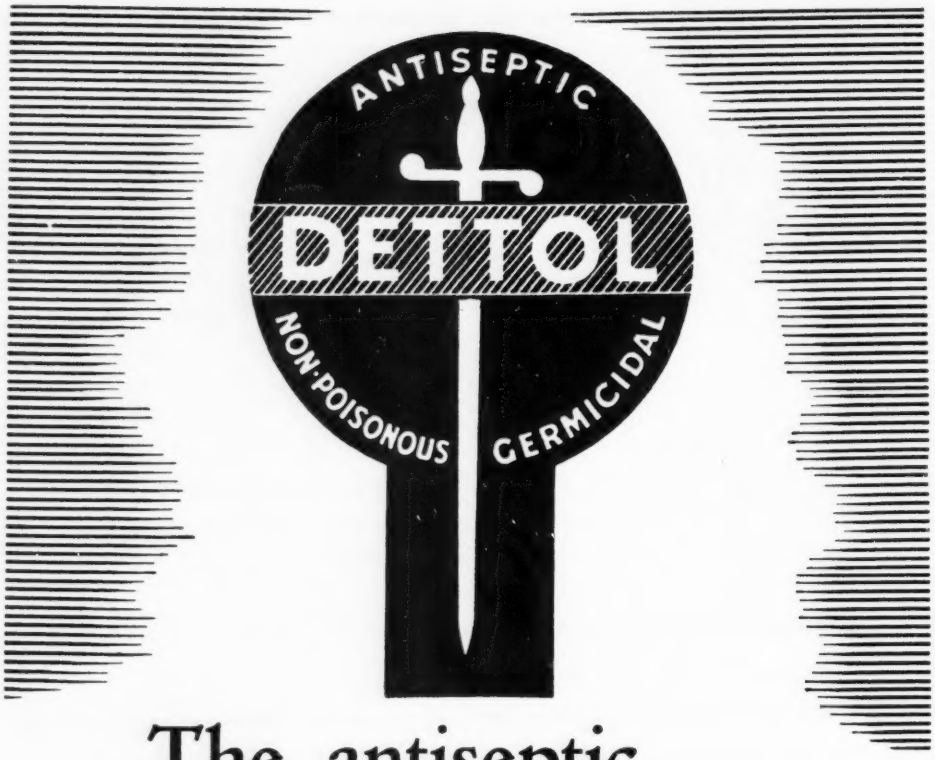

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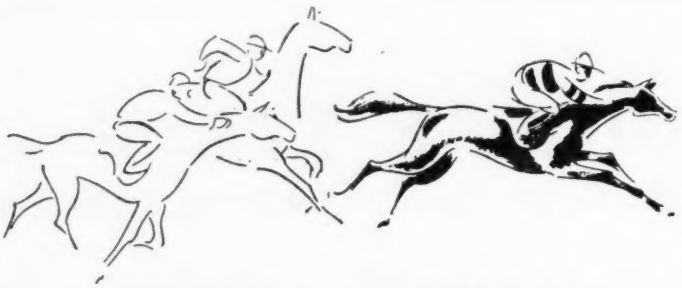

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Along with the Chemical research which has effected improvements in the qualities of **HESACRYL**, three different methods for simplifying its application in the mouth have been tested. These methods are all equally effective. The Dentist may choose without hesitation whichever one he prefers, and which seems best suited to any particular filling.

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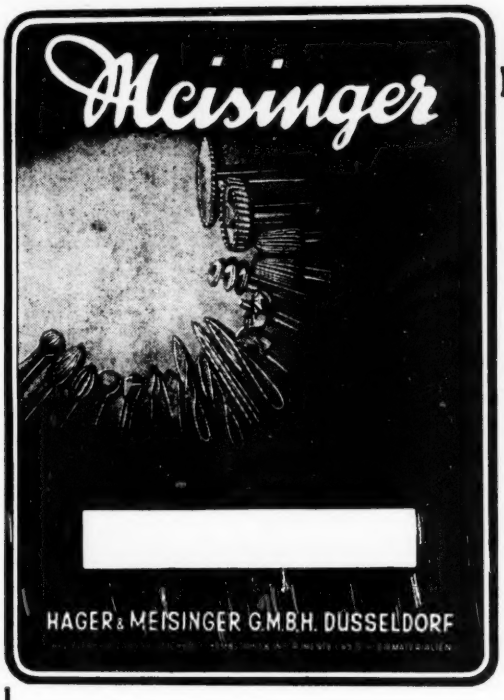

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